Galaxy HDX™

Galaxy Raid

Model GHDX-2422S-8F4D
8 Bay FC-4G to SATA-II RAID Subsystem

Galaxy Raid

Model GHDX-2422S-12F4D
12 Bay FC-4G to SATA-II RAID Subsystem

Installation and Hardware

Reference Manual

Version 060107

RORKE DATA®
A Subsidiary of BELL MICROPRODUCTS

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FCC Class A Radio Frequency Interference Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING:

A shielded power cord is required in order to meet FCC emission limits and also to prevent interference to nearby radio and television reception.

Use only shielded cables to connect I/O devices to this equipment. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

CE

This device is in conformity with the EMC.

CB

(Certified Worldwide)

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.

CCC

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D33225

ITE BSMI Class A, CNS 13438 (for Taiwan)

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This device is in conformity with UL standards for safety.

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This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By proper waste handling of this product you ensure that it has no negative consequences for the environment and human health, which could otherwise be caused if this product is thrown into the garbage bin. The recycling of materials will help to conserve natural resources.

For more details about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

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Safety Precautions

Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.
- The Galaxy FC<>SATA subsystems come with eight (8) or twelve (12) drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.
- If a module fails, leave it in place until you have a replacement unit and you are ready to replace it.
- **Airflow Consideration:** The subsystem requires an airflow clearance, especially at the front and rear.
- Handle subsystem modules using the retention screws, extraction levers, and the metal frames/face plates. Avoid touching PCB boards and connector pins.
- To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that during operation, all enclosure modules and covers are securely in place.
- Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
- Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.
- If it is necessary to transport the subsystem, repackage all disk drives separately. If using the original package material, other replaceable modules can stay within the enclosure.

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad are recommended. Avoid dust and debris in your work area.

About This Manual

This manual:

- Introduces the Galaxy GHDX-2422S-8_12F4D RAID subsystem series.
- Describes all the active components in the subsystems.

- Provides recommendations and details about the hardware installation process.
- Briefly describes how to monitor the subsystem.
- Describes how to maintain the subsystem.

This manual does not:

- Describe components that are not user-serviceable.
- Describe the configuration options of firmware, using terminal emulation programs, or the RAIDWatch GUI software that came with your subsystem.
- Give a detailed description of the RAID processing units, or the RAID controllers embedded within the subsystem.

Revision History

♦ ***Initial release***

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentation

- Generic Operation Manual
- RAIDWatch User's Manual

These two documents can be found in the product utility CD included with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the Galaxy series is referred to as simply the "subsystem" or the "system."

Important Messages

Important messages appear where mishandling of components is possible or when work orders can be misunderstood. These messages also provide vital information associated with other aspects of system operation. The word "important" is written as

"**IMPORTANT**," both capitalized and bold and is followed by text in italics. The italicized text is the important message.

Warnings

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously. Warnings are easy to recognize. The word "warning" is written as "**WARNING**," both capitalized and bold and is followed by text in italics. The italicized text is the warning message.

Cautions

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system. Cautions are easy to recognize. The word "caution" is written as "**CAUTION**," both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Notes

Notes inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes. Notes are easy to recognize. The word "note" is written as "**NOTE**," both capitalized and bold and is followed by text in italics. The italicized text is the note message.

Steps

Steps describe the sequential tasks in a specific work procedure. Following the steps in their proper order helps guarantee effectiveness and lowers the chance of making mistakes.

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot "•."

Numbered Lists: Numbered lists describe sequential steps you should follow in order.

Software and Firmware Updates

Please contact your system vendor for the latest software or firmware updates. ***NOTE*** that the firmware version installed on your system should provide the complete functionality listed in the specification sheet/user's manual. We provide special revisions for various application purposes. Therefore, **DO NOT** upgrade your firmware unless you fully understand what a firmware revision will do.

Problems that occur during the updating process may cause unrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

Chapter 1
Introduction

1.1. Product Overview

1.1.1 Product Introduction

This hardware manual briefly introduces the single controller Galaxy 12 bay and 8 bay, Fibre Channel (FC)-to-Serial ATA (SATA) RAID subsystem as shown below.

Figure 1-1: Galaxy 12 bay Fibre to SATA RAID Subsystem

Figure 1-2: Galaxy 8 bay Fibre to SATA RAID Subsystem

1.1.2 Model Variations

There are two available models in the 2U version of the Galaxy SATA-II RAID subsystem series. Below is a comparison chart listing major components of the two models.

	GHDX-2422S-12F4D	GHDX-2422S-82F4D
Number of Drive Bays	12	8
RAID Controller	1	1
Host Channels	FC-4G x 2	FC-4G x 2
PSUs	2	2
Cooling Modules	3	2
LCD Panel	1	1
Battery Support	Optional	Optional

Table 1-1: Available FC-to-SATA RAID Subsystem Models

NOTE:

On receiving and unpacking your subsystem, please check the package contents against the included unpacking checklist. If any modules appear to be missing, please contact your subsystem vendor immediately.

1.1.3 Enclosure Chassis

1.1.3.1 Chassis Overview

The Galaxy 12 bay and 8 bay subsystems come in a 2U metal chassis. A backplane board divides the enclosure internally into front and rear sections. (See ***Figure 1-3***) The front section accommodates twelve (12) or eight (8) drive trays (with their associated hard drives) and the rear section accommodates two (2) PSU modules, two (2) or three (3) single-fan cooling modules, and a single RAID controller module. The two (2) forearm handles on the front of the subsystem enable you to easily insert/extract the chassis into/from a rack or cabinet. Pre-drilled mounting holes on the sides of the chassis allow you to attach separately purchased slide rails.

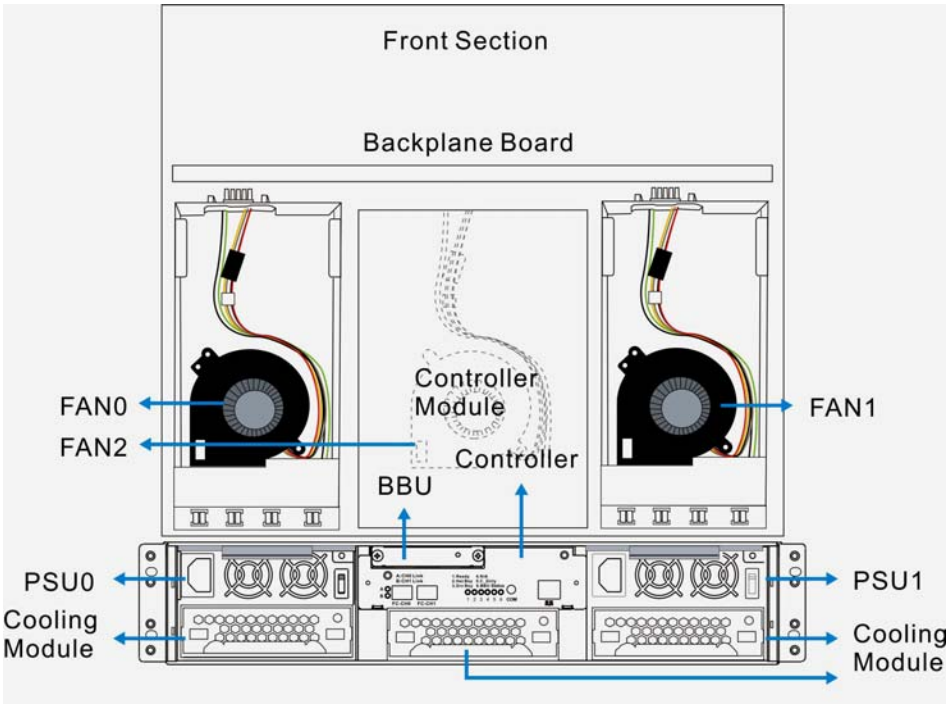

Figure 1-3: Galaxy 12-bay SATA RAID Subsystem Overview

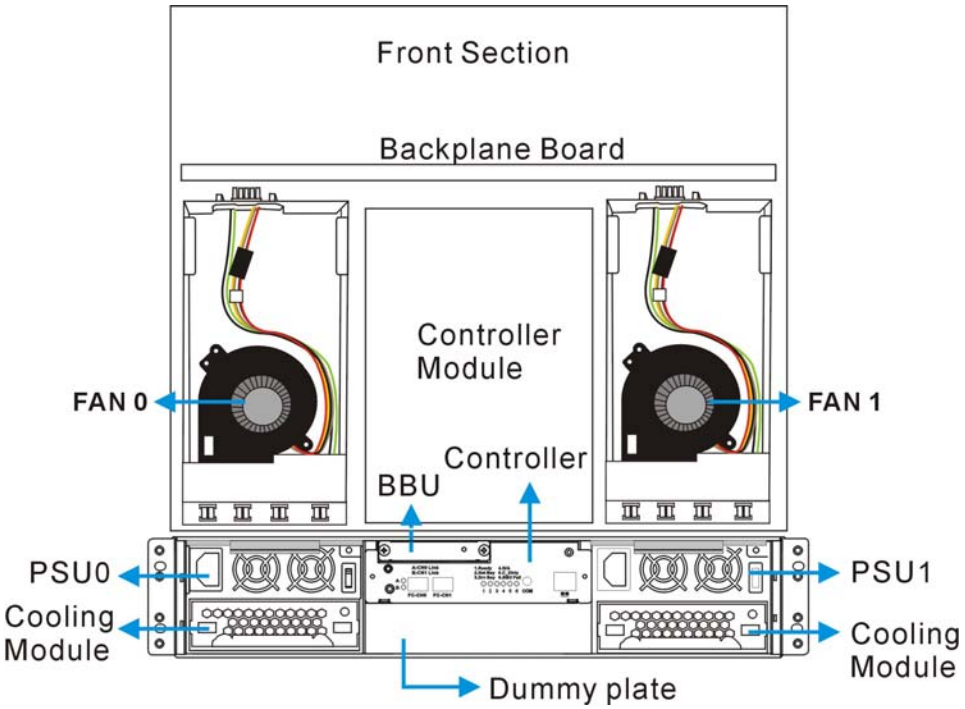

Figure 1-4: Galaxy 8 bay SATA RAID Subsystem Overview

CAUTION!

When working with the subsystem, it is important to use tools with extreme care. Do not place tools or other items on top of the enclosure to help avoid damaging the outward appearance of the chassis.

1.1.3.2 Physical Dimensions

The subsystems come in a standard 2U, 19" chassis with the following dimensions:

- Measured with forearm handles: 482mm x 88mm x 505mm (width x height x depth)
- Measured without forearm handles: 446mm x 88mm x 490mm (width x height x depth)

NOTE:

*Components accessed through the front panel are referred to as "**Front Panel Components**" and Components accessed through the rear panel are referred to as "**Rear Panel Components**."*

1.1.3.3 Front Panel Overview

The front section of the subsystem features a 4 x 2 or 4 x 3 layout for eight (8) or twelve (12) 3.5-inch disk drives and a foldable LCD keypad panel. The front sections of the RAID subsystems described in this manual are shown in ***Figure 1-5*** and ***Figure 1-6.*** A description of each front panel component is given below:

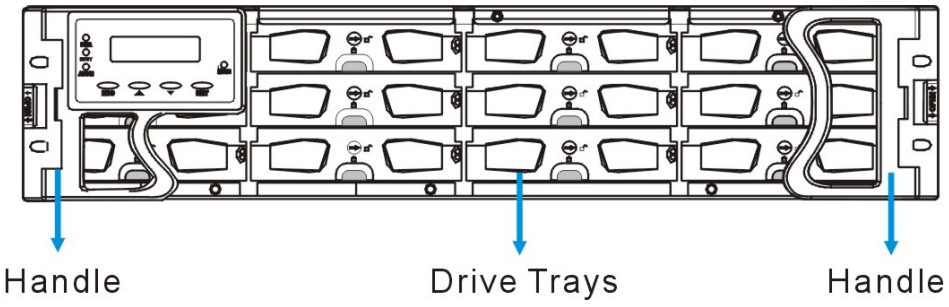

Figure 1-5: Galaxy 12 bay RAID Subsystem Front View

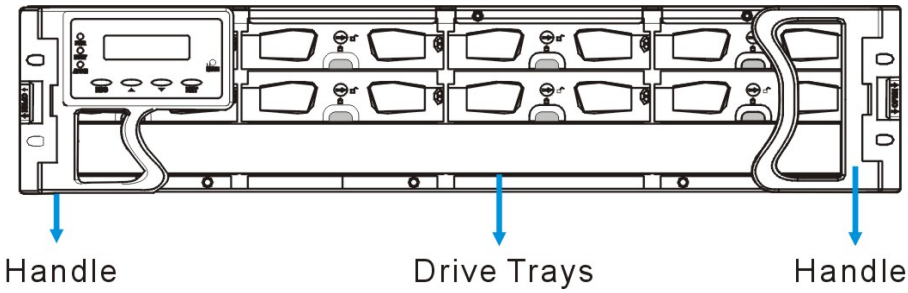

Figure 1-6: Galaxy 8 bay RAID Subsystem Front View

The front section shown above is designed to accommodate the following components:

- ***Forearm handles with an LCD keypad panel:*** The LCD Panel mounted on the left handle shows system information and provides local access to the firmware-embedded configuration and monitoring utility.

- ***Drive bays with drive tray canisters:*** The drive bays are used to house the subsystem hard drives. The **GHDX-2422S-12F4D** contains 12 drive bays while **GHDX-2422S-8F4D** contains 8 drive bays with a blank plate covering the lower part of the front panel.

1.1.3.4 Hard Drive Numbering

The subsystems are housed in an enclosure that is 4 bays wide and 3 or 2 bays high. When viewed from the front, drive bays (slots) are numbered 1 to 12 (See ***Figure 1-7)*** or 1 to 8 (See ***Figure 1-8***), from the left to the right, and then from the top to the bottom.

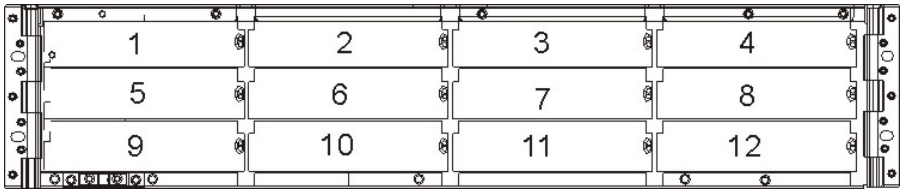

Figure 1-7: 12 Drive Bays Numbering Sequence

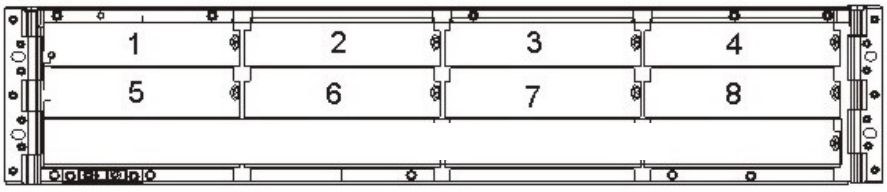

Figure 1-8: 8 Drive Bays Numbering Sequence

1.1.3.5 Rear Panel Overview

The rear section of the subsystems are accessed through the rear panel and is reserved for a single RAID controller module, one (1) battery backup unit (BBU), two (2) power supply units (PSUs), and three (12 bay) or two (8 bay) cooling modules.

The subsystem rear views are shown in ***Figure 1-9*** and ***Figure 1-10***. A description of each rear panel component is given in the proceeding discussions:

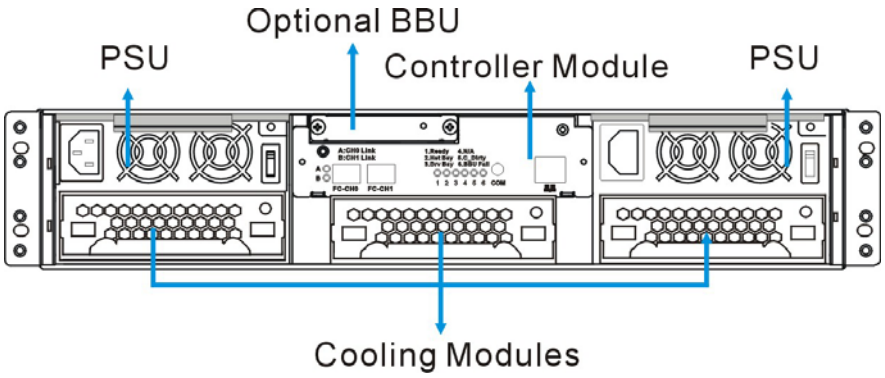

Figure 1-9: GHDX-2422S-12F4D Rear View

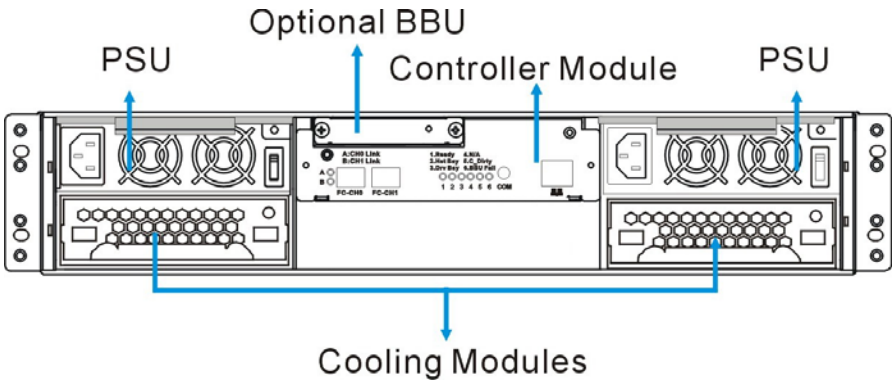

Figure 1-10: GHDX-2422S-8F4D Rear View

The rear panels shown above are designed to accommodate the following components:

- ***RAID controller module*:** The controller module contains a controller main board and a pre-installed DDR DIMM module.
- ***Power Supply Unit (PSU):*** The PSU is used to provide power to the subsystem.
- ***BBU module:*** A BBU comes as an optional module which provides the protective implementation to cached data; and, unless deselected when purchasing the subsystems, is installed into the module slot located at the upper left corner of the controller module.

- ***Cooling module:*** The redundant cooling modules are used to ventilate the subsystem and to reduce the temperature within the subsystem. The 12-bay model has an additional cooling module installed in the bottom module bay.

NOTE:

Each of the power supplies on the sides of the enclosure houses one cooling module in a retrievable canister. When a power supply is removed, the cooling module is also removed. Therefore, replace the power supply unit as fast as possible whenever it becomes necessary. Cooling modules can be independently removed from the chassis without affecting PSU operation.

1.1.3.6 Backplane Board

An integrated back-plane board separates the front and rear sections of the 12 bay Galaxy subsystems. This PCB board provides logic level signal traces and low voltage power paths. It contains no user-serviceable components.

1.2. Subsystem Components

1.2.1 LCD Panel

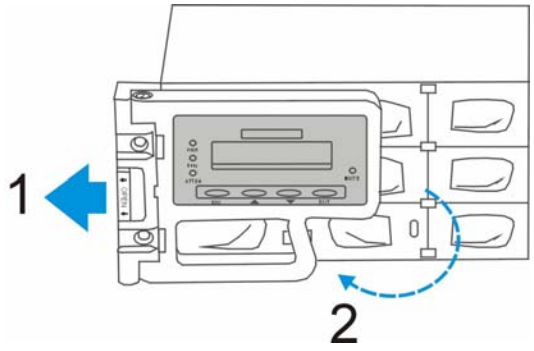

Figure 1-11: Opening the Front Handle

The LCD panel shown in ***Figure 1-11*** consists of a 16 characters x 2 rows LCD screen with push buttons, a mute button, and LED status indicators. The LCD front panel provides full access to all array configurations and monitoring. After powering up the subsystem, the initial screen will show the subsystem model name. A different name can be manually assigned to the subsystem or to different drive arrays. This will enable easier identification in a topology consisting of numerous arrays.

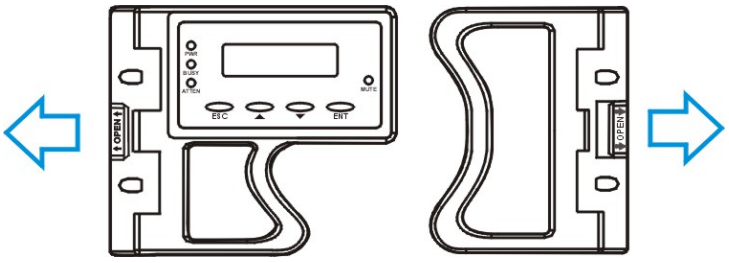

Figure 1- 12: Front Panel Retention Latch

To access drive bays in the left- or right-hand side column, first flip the retention latches (see ***Figure 1- 12***) on the enclosure front handles, and then swing the handles to the left- and right-hand sides. To close the handles (see ***Figure 1- 13*****),** swing the handles toward the system; gently press the handles until a click is heard. The latches will keep the handles in place.

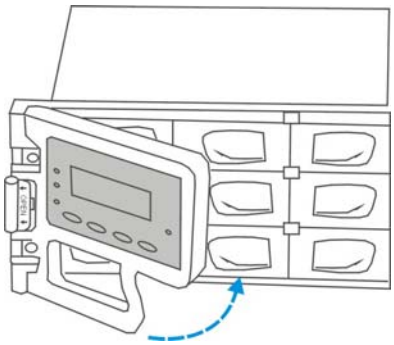

Figure 1- 13: Closing the Front Handles

1.2.2 Drive Trays

Part Number: GALHDX-9273CDTray

The subsystems come with 12 or 8 drive trays (as shown below) designed to accommodate separately purchased standard 1-inch pitch, 3.5-inch disk drives. The drive bays are accessed from the enclosure front. Two LED's on the front of the tray are used to indicate the drive status. A key-lock on each drive tray secures the hard drive in place, while an easily accessible release button ensures fast and efficient drive hot-swapping.

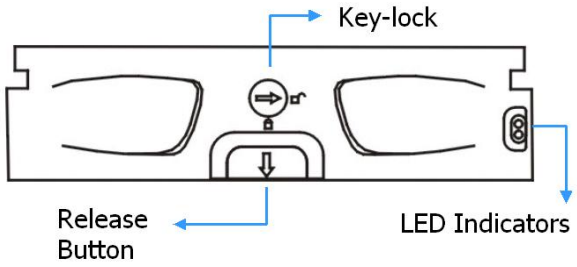

Figure 1-14: Drive Tray Front Bezel

WARNING!

Be careful not to warp, twist, or contort the drive tray in any way (e.g., by dropping it or resting heavy objects on it). The drive tray has been customized to fit into the drive bays in the subsystem. If the drive bay superstructure is deformed or altered, the drive trays may not fit into the drive bay.

1.2.3 RAID Controller Modules

Part Number:

12-bay GHDX-2422S-12F4D→PN: GALHDX-7370S-U320 (w/ 256MB DDR DIMM)

8-bay GHDX-2422S-8F4D→ PN: GALHDX-7370S-U320 (w/ 256MB DDR DIMM)

The RAID controller module contains a main circuit board, a preinstalled 256MB capacity or above DDR RAM DIMM module, and the necessary support interfaces. The controller module contains no user-serviceable components. Except when replacing a faulty unit or installing/upgrading the cache memory inside, the controller module should never be removed or opened.

The two models' rear-facing controller faceplates look identical.

WARNING!

Although the RAID controller can be removed, the only time you should touch the controller itself is to replace the memory module or to install the memory module. The RAID controller is built of sensitive components and unnecessary tampering can damage the controller.

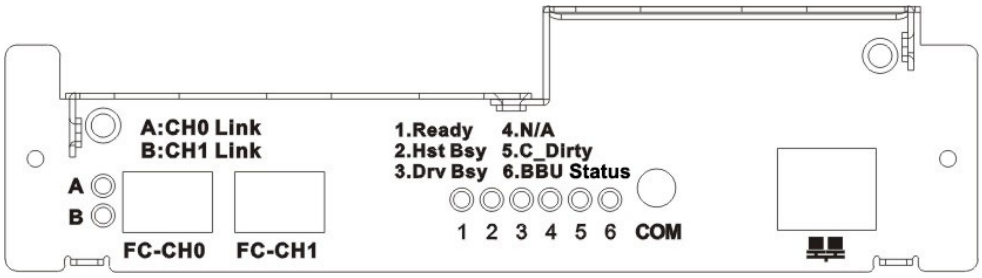

Figure 1-15: Controller Module Faceplate for GHDX-2422S-12F4D

All external interfaces that connect to external devices are located on the controller module rear panel. The interfaces are listed below.

- **Host Ports**

FC-4G Host Ports: The RAID controller module has two (2) SFP sockets labeled **FC-CH0** and **FC-CH1**. Two FC-4G host channels connect the subsystem to the host computers equipped with FC-4G Fiber-optic compatible adapters. The Fibre Channel host ports receive SFP transceivers and then to LC-type cables. These SFP ports can auto-negotiate the speed and determine the data transmission rate.

NOTE:

This subsystems come with preset configurations for channel mode and channel ID settings, and should be sufficient for most applications.

- **Ethernet Port**

All controller modules on the subsystems come with a single 10/100BasedT RJ-45 Ethernet port. The Ethernet port is used for local or remote management through the network using the RAIDWatch GUI manager or Telnet protocol.

- **COM Port**

All controller modules come with one RS-232C (audio jack) serial port. The serial port is used for local access to the system-embedded configuration utility over the included serial port cable.

DIMM Module

The controller module comes with a preinstalled 256MB capacity or above DDR RAM DIMM module and can support a larger capacity up to 2GB. The DIMM module is mounted in an easily accessible location on the controller board. However, when the DIMM module is being changed, the controller module must be removed from the subsystem chassis.

1.2.4 Optional BBU Module

Part Number: - GALHDX-9273CBT-C

An optional, separately purchased Li-ION battery backup unit (BBU) module can sustain cache memory for days after a power failure. If you purchased a BBU, it will be installed on the upper left corner of the controller module in the rear of subsystem chassis. Please refer to ***Chapter 2*** for installation details.

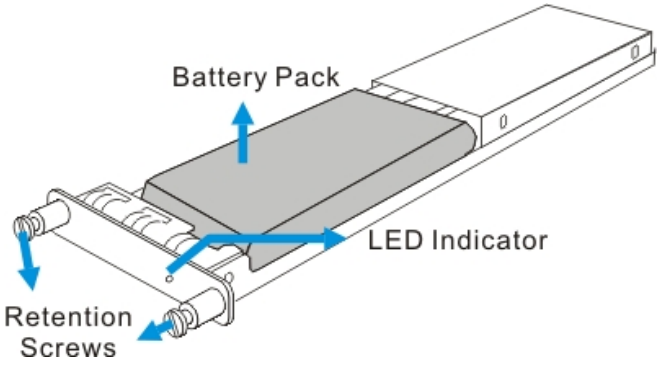

Figure 1-16: BBU Module

In accordance with international transportation regulations, the BBU module is only charged to between 35% and 45% of its total capacity when shipped. Therefore, when powering on the subsystem for the first time (see ***Section 4.4***) the BBU will begin to charge its batteries to their full capacity. It normally requires approximately seven (7) hours for the battery to be fully charged. If the battery is not fully charged after seven (7) hours (its LED is still flashing), there is a problem with the BBU module and you should contact your subsystem vendor immediately. While the battery is being charged, the LED on the BBU rear panel and the fifth LED on the controller module will flash. (See ***Chapter 3*** for details on the LED indicators.)

You can check the status of the battery's charge via RAIDWatch manager or the firmware utility screen.

1.2.5 Power Supply Units

Part Number: GALHDX-9272CPSU

PN: GALHDX-9272CPSU

The SATA-based Galaxy subsystems are equipped with two (2) redundant, hot-swappable, 2U-profile, 350W power supply unit (PSUs) modules. The PSU is permanently mounted into a 2U high (dual-level) bracket especially designed to house both the PSU and a cooling module mounted underneath. PSUs can be found on either side of the controller module.

Each PSU comes with a single power socket for power cord plug-in and a single power switch for you to turn the PSU on and off. Each PSU also comes with two embedded cooling fans to provide sufficient airflow to keep the PSU cool. A single LED is used to indicate the PSU status. A handle at the back of the PSU has been especially designed to enable you to remove the PSU from the subsystem while the system is still online. This should only be done if the PSU has failed and needs to be replaced.

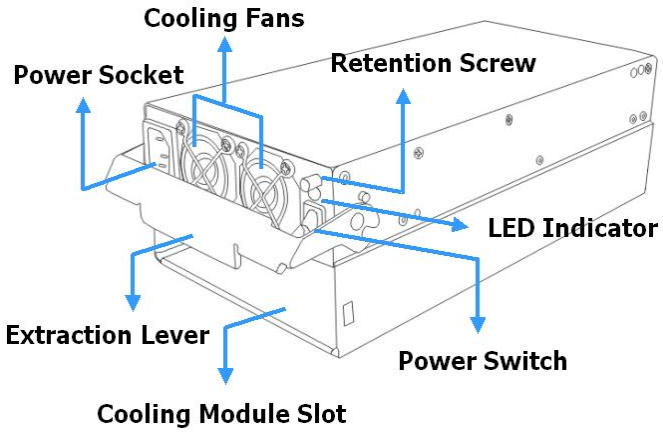

Figure 1-17: PSU Module

NOTE:

Hot-swapping the PSU also removes the cooling module at the lower slot.

A retention screw at the upper right corner of the PSU module is used to secure the PSU to the enclosure. If the PSU needs to be removed, the retention screw must be removed first. When installing a new PSU module, make sure that the retention screw has been firmly secured.

PSU specifications are shown in ***Appendix B***.

1.2.6 Single-fan Cooling Modules

Part Number: GALHDX-9272CfanModE

The SATA-based Galaxy subsystems are equipped with two (for the 8-bay model) or three (for the 12-bay model), 1U single-fan, redundant, hot-swappable cooling modules shown in ***Figure 1-18.*** One 9.7cm fan is housed in each cooling module. These modules have been designed to generate a cooling flow from the front to the rear of the subsystem to extract the heat generated by the SATA hard drives. Two of the cooling modules are installed directly beneath the PSUs. For the 12-bay subsystem, a third module is located directly beneath the controller module.

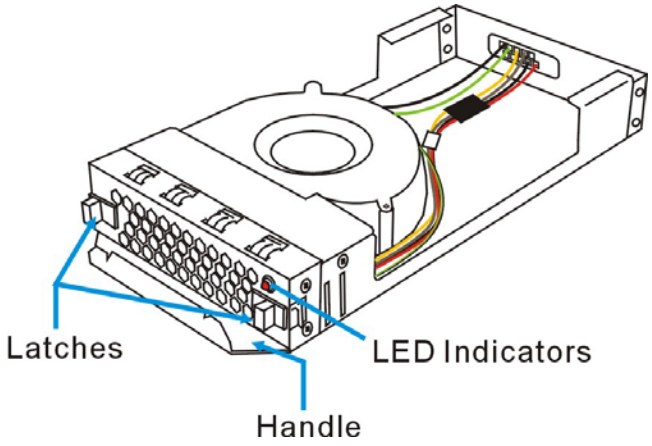

Figure 1-18: Top View of a Single-fan Cooling Module

Advanced Fault-Preventative Operation

The cooling modules support dual-speed operation modes that help to protect the subsystem in the event of component failure or extreme working conditions.

Intelligent Dual Speed Operation

The cooling fans operate with two rotation speeds. Under normal operating conditions, the cooling fans run at the low speed, which is sufficient for maintaining efficient airflow across components. Under the following conditions, cooling fans raise their rotation speed to increase the airflow:

1. Component Failure: if another cooling module, a PSU, or a temperature sensor fails, the remaining cooling fan(s) automatically raises its rotation speed.

2. Elevated Temperature: if the temperature breaches the upper threshold set for any of the interior temperature sensors, the cooling fans automatically raises its rotation speed.

3. During the subsystem initialization stage, the cooling fans operate at the high speed and return to lower speed once the initialization process is completed and no erroneous condition is detected.

NOTE:

There are two values set for the upper temperature thresholds. One is set for event notification and the other triggering higher fan rotation speed. The preset value for event notification can be changed using the firmware-embedded configuration utility, while the fan speed trigger is not a user's option. Please refer to the ***Generic Operation Manual*** *for the options with event notification values.*

1.3. Subsystem Monitoring

The SATA-based RAID subsystems come with a number of different monitoring methods that provide you with continual updates on the status of the system and individual components. The following monitoring features are included in the subsystem.

1.3.1 I²C bus

The following subsystem elements interface to the RAID controller over a non-user - serviceable I^2C bus:

- Power supply status
- Cooling module
- Temperature sensors on the backplane and within the RAID controller module

1.3.2 LED Indicators

The following active components all come with LEDs that indicate the status of the individual components:

- RAID controller
- LCD panel
- Cooling module
- PSU module
- BBU module
- Drive trays

1.3.3 Firmware and RAIDWatch GUI

Firmware: The firmware (FW) is pre-installed software that is used to configure the subsystem. The FW can be accessed through either the front panel LCD module or a terminal emulation program that is installed on an external computer connected to the host.

RAIDWatch: RAIDWatch is a premier web-based graphical user interface (GUI) that can be installed on a remote computer and is used to access the array through LAN or the Internet. The manager communicates with the array via the connection of the existing host interface or Ethernet link to the RJ-45 LAN port.

1.3.4 Audible Alarms

The subsystems come with audible alarms that are triggered when certain active components fail or when certain (controller or subsystem) thresholds are exceeded. If you hear hastily repeated beep tones from the subsystems it is imperative that you immediately determine and rectify the problem.

Event notification messages indicate the completion of or the condition when proceeding with array configuration tasks and are always accompanied by two or three successive and prolonged beeps.

WARNING!

Failing to respond when a critical alarm is heard can lead to permanent damage of the subsystem. When an audible alarm is heard, rectify the problem as soon as possible.

1.4. Hot-swappable Components

1.4.1 Hot-swap Capabilities

The Galaxy ***GHDX-2422S-8F4D*** and ***GHDX-2422S-12F4D*** subsystems come with a number of hot-swappable components. A hot-swap component is one that can be exchanged while the subsystem is still online without affecting the operational integrity of the subsystem. These components should only be removed from the subsystem when they are being replaced. At no other time should these components be removed from the subsystem.

1.4.2 Components

The following components are all hot-swappable:

- Power supply units (PSUs)
- Cooling modules

- Hard drives
- BBU module

NOTE:

Instructions on how to replace these hot-swappable are given in Chapter 5.

1.4.3 Normalized Airflow

Proper subsystem cooling is referred to as “normalized” airflow. Normalized airflow ensures the sufficient cooling of the subsystem and is only attained when all components are properly installed. Therefore, a failed component should only be hot-swapped when a replacement is available. If a failed component is removed but not replaced, permanent damage to the subsystem can result.

Chapter 2
Hardware Installation

2.1 Introduction

This chapter gives detailed instructions on how to install the subsystem. When installing the subsystem, it is necessary to mount the chassis into a rack or cabinet and to install hard drives and drive trays. Installation into a rack or cabinet should occur before the hard drives or drive trays are installed into the subsystem. Please confirm that you received all of the components listed on the ***Unpacking List*** that came with the subsystem before proceeding with the installation process.

CAUTION!

Please note that the installation instructions described in this chapter should be carefully followed to prevent any difficulties and damages to your system.

2.2 Installation Pre-requisites

1. ***Static-free installation environment:*** The subsystem must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage. (See ***Section 2.3***)

2. **Component check:** Before installing the subsystem, you should confirm that you have received all of the required components by checking the package contents against the Unpacking Checklist. If any items appear damaged, contact your vendor for a replacement.

3. ***Hard drives:*** SATA-II hard drives have been pre-integrated into the Galaxy raid trays. These drive trays must be installed before you can operate the Galaxy. If replacement drives are needed, use this procedure to install them into the subsystem. (See ***Section 2.9*** *for installation instructions*)

4. ***Cabling:***

   (1). The subsystems come with no external cables for Fibre Channel connection to a host computer. All host connection cables should be separately purchased. Please see ***Chapter 4*** for sample topologies and configuration options.

SFP transceivers: If the FC cables that were previously purchased do not come with pre-installed SFP transceivers, SFP transceivers with LC-type, multi-mode cables must be separately purchased. (See ***Section 4.2.3***)

(2). One (1) audio-jack-to-DB9 cable is provided to facilitate the connection of the COM1 port for local terminal emulation access to the array.

(3). Two (2) power cords are provided for the power connections to the power sources.

(4). The RJ-45 Ethernet cable for network management connection is a user-supplied item.

5. ***Memory modules:*** If you wish to change the pre-installed memory modules, the separately purchased modules must be installed. Please contact your vendor for a different memory module or consult the list of compatible modules.

6. ***BBU module***: If you wish to use a BBU module, the module can be purchased separately.

7. ***Rack installation:*** The enclosure chassis can be installed into a rack cabinet using self-purchased mounting rails, or Galaxy's ***GAL-9272CEslide28*** or ***GAL-9272CEslide36*** mounting rails. A printed copy of installation guide is provided with the slide rail packages.

2.3 Safety Precautions

2.3.1 Precautions and Instructions

1. Be sure the correct power range (100~120 or 220~240VAC) is supplied by your rack cabinet, UPS device, or power outlet.

2. Thermal notice: All drive trays (even if they do not contain a hard drive) must be installed into the enclosure. Leaving a drive bay or module slot open will greatly affect the efficiency of airflow within the enclosure, and will consequently lead to system overheating. Keep a faulty module in place until you have a replacement unit and you are ready to replace it.

3. An enclosure without disk drives can weigh up to 24 kilograms. Two (2) people will be required to install or relocate the subsystem. Drives should be removed from the enclosure before moving the subsystem.

4. Airflow considerations: The subsystem requires an airflow clearance especially on the front and on the rear. A minimum of 2.5cm is required between the front of the

enclosure and rack cover. A minimum of 5cm is required between the enclosure and the end of the rack.

5. Handle the system modules by the retention screws, eject levers, or the module's metal frame/face plate only. Avoid touching the PCB boards, connector pins, and soldered surfaces.

6. None of the covers or replaceable modules should be removed in order to maintain compliance with safety, emission, or thermal requirements.

7. Always secure every enclosure module by its retaining screws or make sure it is held in place by its latches.

8. Always make sure the subsystem has a safe electrical earth connection via power cords or chassis ground by the rack cabinet.

9. Be sure that the rack cabinet in which the subsystem chassis is to be installed provides sufficient ventilation channels and airflow circulation around the subsystem.

10. Provide a soft, clean surface to place your enclosure on before working on it. Servicing the enclosure on a rough surface may damage the finish of the chassis.

11. If it is necessary to transport the subsystem, repackage all disk drives separately. If using the original package material, all other modules can stay within the enclosure.

2.3.2 Static-free Installation

The subsystem contains static-sensitive electronic components that can be damaged by improper handling and electrostatic discharge (ESD). To prevent ESD damage to any of the components, follow these precautions before touching or handling them:

- Discharge the static electricity from your body by wearing an anti-static wristband or by touching a grounded metal surface.

- Avoid carpets, plastic, vinyl, and styrofoam in your work area.

- Handle all components by holding their edges or metal frame. Avoid touching PCB boards and connector pins.

2.3.3 BBU Warnings and Precautions

The BBU module is an optional item that can sustain cache memory in the event of a power failure or in the unlikely event if both PSUs have failed. Having the protection to cached data by a BBU is highly recommended. The BBU provides additional data security and helps minimize the chance of data loss during power outage.

- Replace the BBU once it shows symptoms failing to hold the charge. Although the life expectancy of a BBU is determined by the times it has been charged or discharged, a BBU can approximately last for one year. If the battery recharge time is obviously longer than the suggested 12 hours, or if the fault LED is lit, replace the battery.

- Install or replace the BBU module only with a BBU module supplied by your subsystem vendor. Use of battery cells provided by another source will void our warranty.

- Always dispose of discharged or used batteries in an ecologically responsible manner. Dispose used BBUs at authorized battery disposal sites only.

- Do not use nor leave the BBU near a heat source or direct sunlight. Heat can melt the insulation and damage other safety features of battery cells, possibly leading it to acid leak and result in flames or explosion.

- Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly causing functional defects, acid leak, and other hazardous results.

- Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.

- Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it, internal short-circuiting can occur, possibly causing functional defects, acid leaks, and other hazardous results.

- If the BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the subsystem and stop using it. If this is discovered when you first use the BBU, return it to your system vendor.

2.4 General Installation Procedure

Following all the instructions provided below can save installation time. Detailed, illustrated instructions for each component are given in the following sections.

CAUTION!

To ensure that your system is correctly installed, please follow the steps outlined below. If you follow these steps, installation will be fast and efficient. If you do not follow these steps, you may have incorrectly installed the hardware.

Step 1. ***Unpack***. Unpack the subsystem and make sure that all the required subsystem components have indeed arrived. (See ***Section 0***)

Step 2. ***Install an optional BBU:*** a battery backup unit is highly recommended for its protection to data integrity. It should be installed prior to operating the subsystem. (See ***Section 2.8***)

Step 3. ***Rack/Cabinet installation.*** If the subsystem is going to be installed in a rack or a cabinet, it should be installed prior to the installation of the hard drives. Installing the subsystem into a rack or cabinet requires at least two people.

Step 4. ***Install hard drives.*** Your hard drives have been pre-integrated into drive trays. Replacement or separately purchased SATA hard drives must be individually installed into the drive trays. (See ***Section 2.9***)

Step 6. ***Install drive trays***. After the hard drives have been installed into the drive trays, the drive trays must be installed into the enclosure itself.

Step 7. ***Connect the cables.*** Use the supplied power cables to connect the subsystem to main power. Use separately purchased FC cables and SFP transceivers to connect the host ports to the Fibre Channel network or host computers. (See ***Chapter 4***)

Step 8. ***Power up.*** Once all of the components have been properly installed and all the cables properly connected, the subsystem can be powered up and the RAID array configured. (See ***Chapter 4***)

2.4.1 Installation Procedure Flowchart

Figure 2-1 shows a flowchart of the installation procedure. As you complete each step, check off the "***Done***" box on the right. Please use this flowchart in conjunction with the instructions that follow.

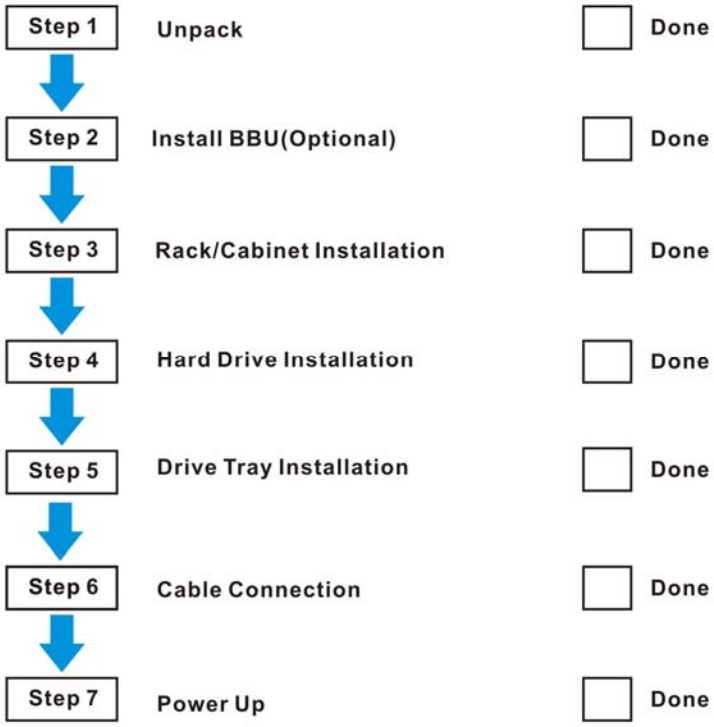

Figure 2-1: Installation Procedure Flowchart

2.5 Unpacking the Subsystem

Use the unpacking checklist in your package to check package contents. Carefully check the items contained in each box before proceeding with installation.

Each packed box is separated into the upper and lower levels.

Upper level: The boxes on the upper level contain:

- Eight (8) or twelve (12) drive canisters
- Accessory items

Lower level: The lower box should contain the enclosure chassis with all the pre-installed components. The pre-installed components should include:

- RAID controller module

- PSU modules
- LCD panel
- Cooling modules
- A backplane

Accessory items are placed in a box in the upper level. They include two power cords, a null modem, screws, an audio jack cable, a printed copy of ***Quick Installation Guide*** and an ***Unpacking Checklist*** and a product utility CD containing the ***Installation and Hardware Reference Manual*** (this document), ***Generic Operation*** (Firmware) ***Manual***, RAIDWatch GUI software and ***RAIDWatch User's Manual***.

2.6 Installation Overview

2.6.1 Pre-installed Components

The following components have been pre-installed in the Galaxy subsystems and therefore do not need to be installed.

- 2 - PSU modules
- Cooling modules: 3 for the 12 drive bays, or 2 for 8 drive bays
- 1 - RAID Controller module
- 1 - Memory DIMM module (mounted on the controller)
- 1 - LCD keypad panel
- 2 - foldable forearm handles
- 1 - backplane

2.6.2 Uninstalled Components

You must install the following components:

- Pre-integrated Raid trays containing hard drives
- FC cables and SFP transceivers
- A separately purchased BBU (a BBU is shipped in a different package)

2.7 Rackmounting

The subsystem is easily installed into a standard 19-inch rack cabinet using the mounting holes on the sides of chassis.

The enclosure chassis can be installed using self-purchased mounting rails, or ***GAL-9272CEslide28*** and ***GAL-9272CEslide36*** rails.

2.7.1 Considerations for Installation Site and Chassis

- Make sure you have an appropriate site location and cables prepared with adequate lengths to connect to main power and other devices.

- At least two people will be required to install the chassis. Disk drives should only be installed after the chassis is properly mounted. The chassis can weigh about 24Kgs without disk drives.

- The following tools are necessary for mounting the chassis:
  - #4 Phillips-head screwdriver
  - Wrenches may be necessary, depending on the rack type
- Use the included M5 or M6 screws for securing the chassis through its front mounting ears.

- More details about the use of optional slide rails are given in the Installation Guide that came with the slide rail package.

2.7.2 Mounting Holes Positions

- Integrators may design their own brackets or slide rails using the twenty-two (22) mounting holes on the sides of chassis.

- There are six (6) mounting holes with six (6) M4 nuts near the end of the chassis on each side. Shown below are the locations of these mounting holes. (See the arrow marks in ***Figure 2-2***). See the next diagram for another group of mounting holes on a horizontal line.

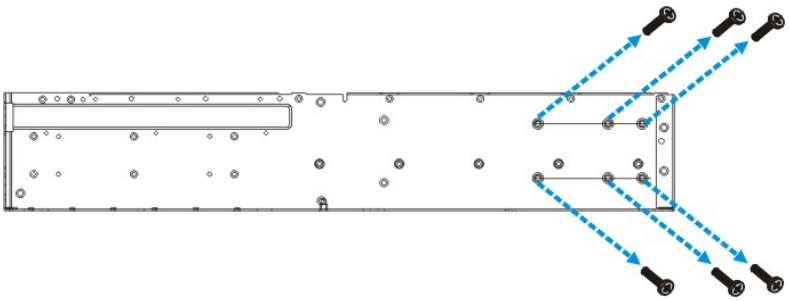

Figure 2-2: Enclosure Side Mounting Holes (1)

- ***Figure 2-3*** shows holes that are designed for slide rail options. There are five (5) mounting holes for #6-32 screws on the sides of the enclosure for use with slide rails purchased separately from us or other vendors.

- You may purchase slide rail options (P/N: GAL-9272CEslide28 & GAL-9272CEslide36). For information on installing the chassis using the slide rails, please refer to the *Installation Guide* that came with the kit.

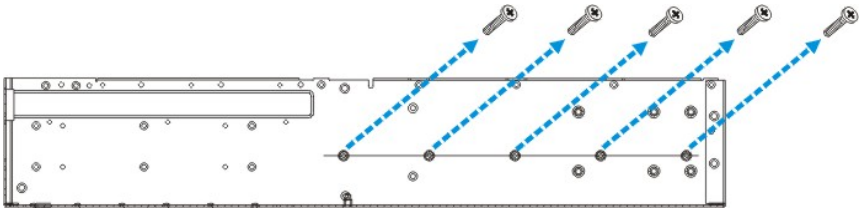

Figure 2-3: Enclosure Side Mounting Holes (2)

- Use M5 or M6 pan-head screws to secure the chassis to the front cabinet posts. The front ear holes are shown in ***Figure 2-4***.

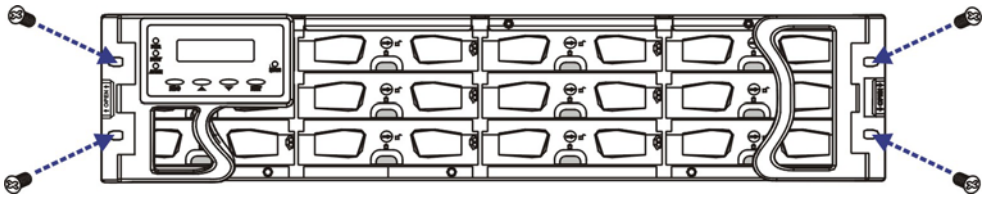

Figure 2-4: Front Ear Holes

WARNING: DO NOT USE JUST THE FRONT EAR HOLES TO MOUNT THE GALAXY IN THE RACK. DATA LOSS OR CORRUPTION MAY OCCUR.

2.8 BBU Installation

2.8.1 BBU Module Installation Overview

The BBU module is an optional item that can sustain cached data in the event of a power outage or in the unlikely event that both PSUs have failed. Purchasing and installing a BBU is highly recommended. The optional BBU provides additional data security and helps minimize the chance of data loss during power shutdowns.

The BBU module is inserted into the subsystem in the module slot at the upper left corner of the controller module. The BBU module is secured to the subsystem with two (2) retention screws. When shipped, the BBU module slot in the subsystem rear panel is covered with a metal dummy plate that must first be removed.

2.8.2 Installation Procedure

To install a BBU into the subsystem, please follow these steps:

Step 1. ***Remove the metal sheet from the chassis***. A metal sheet covers the BBU module slot on the rear panel of the subsystem. The metal sheet is attached to the chassis with two (2) screws. These screws must be removed. To loosen, turn the screws counterclockwise. (See ***Figure 2-5***)

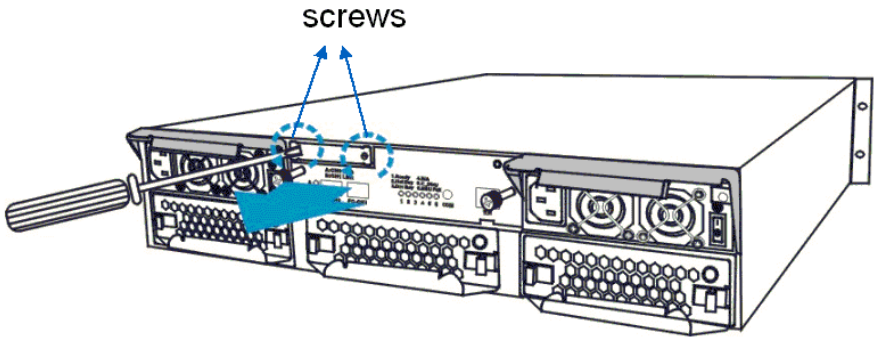

Figure 2-5: Remove the Metal Sheet Retention Screws

Step 2. Once the retention screws are loosened, wedge a screwdriver between the back of the dummy plate and the interior wall of the subsystem enclosure. Gently lever the dummy plate out of the enclosure. (See ***Figure 2-6***)

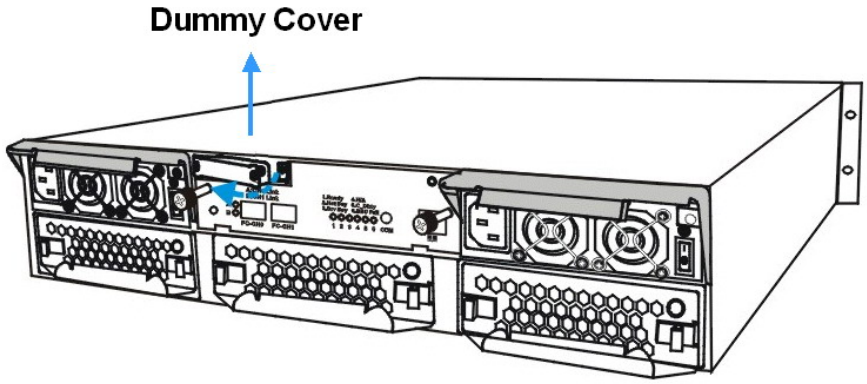

Figure 2-6: Removing the BBU Slot Dummy Plate

Step 3. ***Install the BBU module.*** Align the BBU module with the BBU module slot and gently insert the BBU module until the back of the BBU module reaches the end of the slot.

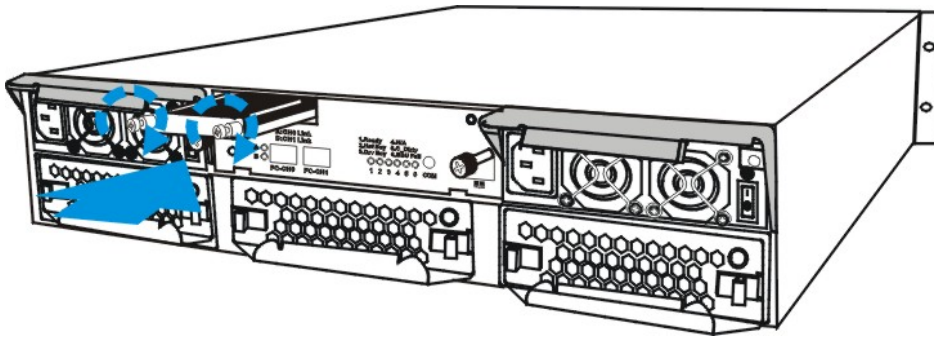

Figure 2-7: Installing the BBU Module

Step 4. ***Secure the BBU module to the enclosure***. Tighten the two (2) retention screws on the back of the BBU module. The BBU module comes equipped with a charger circuit. Once the BBU is properly installed, the installation process is completed.

IMPORTANT!

If a BBU is added when the subsystem has already been put to use, reset the subsystem for the configuration change to take effect. Although a BBU can be added online, the BBU module will only be functional after a subsystem reset.

2.9 Hard Drive Installation

NOTE:

Your hard drives have been pre-integrated and tested. Use the following hard drive procedure when a faulty drive needs replacement.

2.9.1 Hard Drive Installation Overview

WARNING!

1. *Handle hard drives with extreme care. Hard drives are very delicate. Dropping a drive onto a hard surface (even from a short distance) and hitting or touching the circuits on the drives with your tools may all cause damage to drives.*

2. *Observe all ESD prevention methods when handling hard drives.*

3. *Only use screws supplied with the drive canisters. Longer screws may damage the drive.*

2.9.2 Hard Drive Installation Prerequisites

CAUTION!

The hard drives and drive trays should only be installed into the subsystem once the subsystem has been mounted into a rack cabinet. If the hard drives are installed first, the subsystem will be too heavy to place into position and the possible impact during installation may damage your drives.

Replacement hard drives for the subsystem must be purchased separately. When purchasing the hard drives, the following factors must be considered:

- ***Capacity (MB/GB)*:** Use drives with the same capacity. RAID arrays use a "least-common-denominator" approach. The maximum capacity of each drive used in the array is the maximum capacity of the smallest drive. Use drives of the same capacity.

- ***Profile*:** The drive trays and bays of the system are designed for 3.5-inch wide x 1-inch high hard drives. It is highly recommended that you do not try to use drives of any other size.

- ***Drive type:*** The subsystem described in this manual can use either SATA-II or SATA-I hard drives.

2.9.3 Drive Installation

SATA drives can be immediately installed into the drive trays.

Step 1. ***Correctly orient the hard drive.*** Prior to installing the hard drive into the drive tray, make sure that the drive's SATA connector is facing the back of the drive tray.

Step 2. ***Adjust the drive's location*** until the mounting holes in the drive canister are aligned with those on the hard drive. Secure the drive with four supplied 6/32 flathead screws.

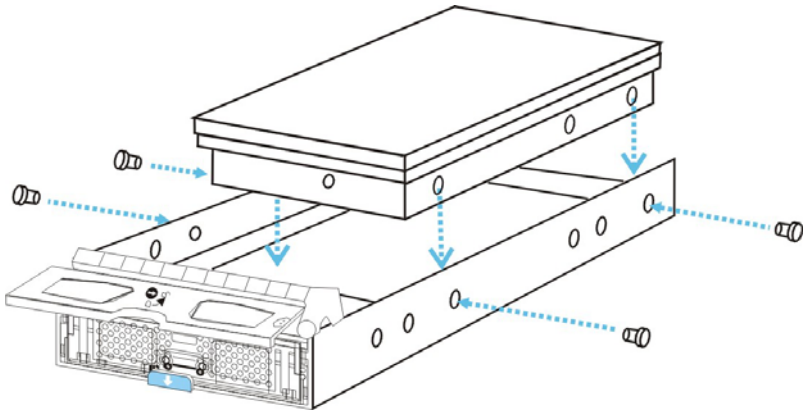

Figure 2-8: Insert the Hard Drive and the Retention Screws

2.10 Drive Tray Installation

Once the hard drives have been installed in the drive trays, the drive trays must be installed into the subsystem.

WARNING!

All drive trays must be installed into the enclosure even if they do not contain a hard drive. If the trays are not installed into the enclosure, the ventilation required for cooling will be disturbed and the subsystem will overheat.

Step 1. Make sure that the hard drive is secured to the drive tray. ***Make sure the key-lock is in the unlocked position***. The key-lock is unlocked if the groove on its face is in a horizontal orientation. If the groove is in a vertical position, as shown in ***Figure 2-9,*** then the key-lock is locked and the front flap on the drive tray cannot be opened.

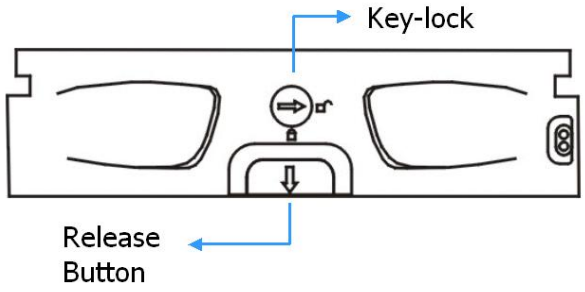

Figure 2-9: Front View of an Individual Drive Tray

Step 2. ***Open the front flap on the drive tray.*** (See ***Figure 2-10***) To open the front flap, push the release button (shown in ***Figure 2-9***) on the front bezel. The front flap will open in an upward direction.

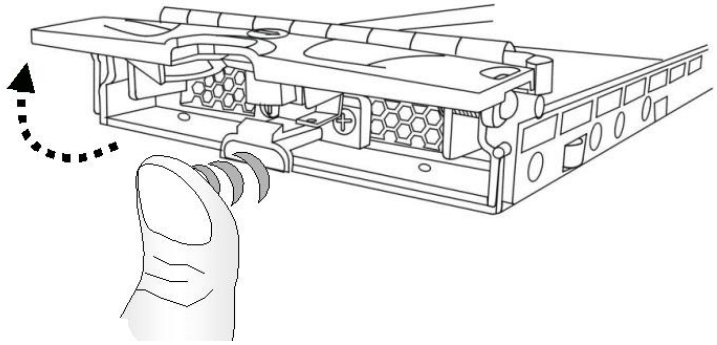

Figure 2-10: Open Drive Tray Front Flap

Step 3. ***Align the drive tray up with the slot*** in which you wish to insert it. Make sure that it is resting on the rails inside the module slot. Once the drive tray is lined up with the slot, gently slide it in. This should be done smoothly and gently.

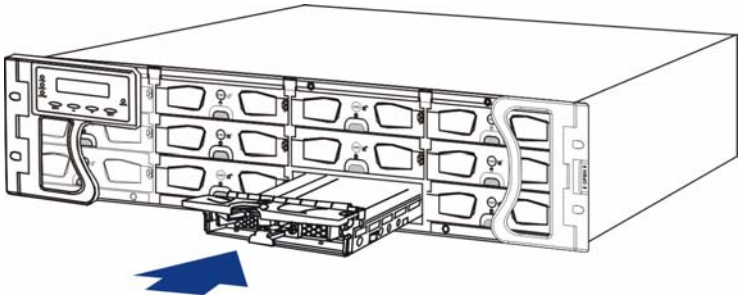

Figure 2-11: Installing a Drive Tray

Step 4. ***Close the front flap on the drive tray***. Make sure the front flap is closed properly. Closing the front flap ensures that the drive tray is firmly connected to the corresponding connector on the backplane board. If the front flap is not closed properly, the connection between the HDD and the subsystem will not be secure. DO NOT SLAM the drive tray into place! The connector pins might be damaged. If the front flap is not closed properly, the connection between the hard drive and the subsystem will not be secure.

Step 5. ***Lock the flap into place.*** To lock the flap into place, turn the key-lock until the groove on its face is in a vertical orientation.

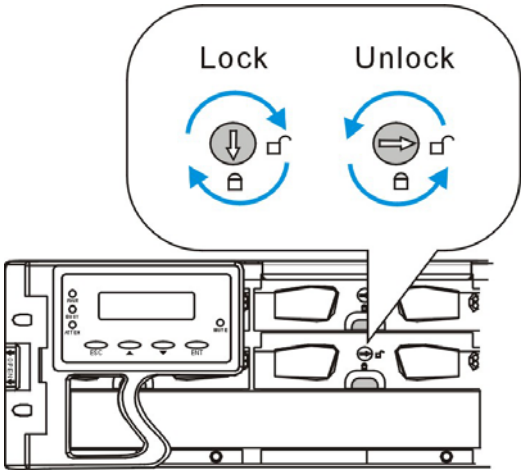

Figure2-12: Drive Tray Key-lock Rotation

Step 6. Once all drive trays are installed, the RAID subsystem will poll the drive channels and recognize the drives and scan them in automatically.

When powered up, you should check the LEDs on drive bezels to ensure all drives are receiving power and are functional. All drive LEDs should be solid green after the initialization stage.

Chapter 3
Subsystem Monitoring

This chapter provides information on how to monitor the Galaxy RAID subsystems.

3.1 Subsystem Monitoring Overview

The subsystem is equipped with a variety of self-monitoring features that keep you informed of the subsystem's operational status. These monitoring features provide vital feedback to help you maintain the operational integrity of the subsystem. Prompt response to warnings and component failure notifications will improve the overall operation and help ensure the longevity of the RAID subsystem.

Self-monitoring features include:

- ***Firmware (FW):*** The RAID controllers in the subsystems come with pre-installed FW. The FW can be accessed using either the LCD keypad panel or a PC running terminal software through the RS-232C (audio jack) serial port. Device status information can be obtained from the FW. The FW capabilities have been fully described in the ***"Fibre to SATA RAID Subsystem Operation Manual***" that came with your subsystems. Please refer to this manual for further information.

- ***RAIDWatch:*** RAIDWatch is a fully integrated Java based Graphical User Interface (GUI) that came with the subsystem and can be used to monitor and maintain the subsystem using web browsers. Connection to a RAIDWatch station is made using the existing Ethernet ports.

  The RAIDWatch Panel View can be customized to show a direct, graphical representation of the subsystem in the content panel of the RAIDWatch screen. Panel View allows you to quickly determine the operational status of critical components. Detailed information for the RAIDWatch manager is given in the ***RAIDWatch User's Manual*** included in the ***Product Utility CD*** that came with your subsystem.

- ***Configuration Client***: The powerful ***Configuration Client*** sub-module can be used to keep you informed of system events via a variety of communication methods like email, LAN broadcast, fax, pager, MSN messenger and SMS. The sub-module runs as an independent program from RAIDWatch main program. The Configuration Client helps prevent blind time and keeps you constantly informed as to the status of the storage management subsystem. Instructions on

how to activate the Configuration Client functionality are given in the ***RAIDWatch User's Manual***.

- ***LEDs***: Device status indicating LEDs are placed on all of the subsystem's active components. These LEDs inform you of the integrity of a given component or of a given FC link. You should become familiar with the different LEDs that are present on the subsystem and be aware of their functions.

- ***Audible alarm***: An audible alarm is present on the subsystem controller board and will be triggered if any of a number of threatening events occurs. These events usually jeopardize the functional and operational integrity of the controller board and must be heeded at all times. Events such as a breach of the temperature threshold will trigger the alarm and if an onsite subsystem manager is present, the manager should use either the LCD panel or the terminal station to determine the cause of the alarm and take the appropriate corrective measures.

- ***I^2C:*** Sensors and presence detect signals are implemented through an I^2C serial bus that is used to monitor the operational integrity of the cooling and PSU modules; or collect data from temperature sensors (present/not present, ready/fail, etc.).

Subsystem monitoring is a necessary part of subsystem management. When failure events or other disruptive events are detected and reported, the subsystem manager must take the appropriate action to rectify the problem. Failure to act in a properly specified manner to a system event (such as overheating) can cause severe and permanent damage to the subsystem.

3.2 Status-indicating LEDs

3.2.1 Brief Overview of the LEDs

The following devices come with LEDs that inform subsystem managers about the operational status of the component on which they are mounted. The subsystems feature status-indicating LEDs distributed over the active components in the following ways:

Component	LED(s) per Unit	Total LEDs	Definition
Drive Trays	2	24 – 12 bay 16 – 8 bay	See ***Section 3.2.5***
Controller Module	5	5	See ***Section 3.2.2***
Ethernet Ports	2	2	See ***Section 3.2.3***
BBU Module (if BBU is installed)	1	1	See ***Section 3.2.8***
PSU Module	1	2	See ***Section 3.2.6***
LCD Keypad Panel	3	3	See ***Section 3.2.4***
Cooling Module	1	3 – 12 bay 2 – 8 bay	See ***Section 3.2.7***

Table 3-1: LED Distribution

3.2.2 Controller Module LEDs

The rear-facing faceplate of the controller module is shown in ***Figure 3-1.*** The relative locations of LEDs are the same on either the ***GHDX-2422S-8F4D*** or the ***GHDX-2422S-12F4D***. The LEDs are numbered from **1** to **5**. There are two more LEDs on the Ethernet port. The LED definitions are shown in ***Table** 3-2* below.

The two models' rear-facing faceplates look identical.

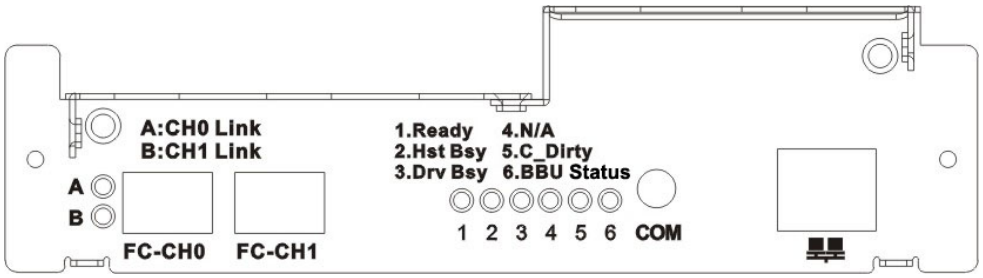

Figure 3-1: GHDX-2422S-12F4D RAID Controller Faceplate

LED	Name	Color	Status
1	**Ready**	Green	**Flashing** indicates that the controller is being initialized. **ON** indicates that the controller has successfully booted, is active, and operating properly. **OFF** indicates that the controller is not ready for operation.
2	**Hst Bsy** (Host Ports Active)	Green	**FLASHING:** Activities on the host ports. **OFF:** No activities on the host ports.
3	**Drv Bsy** (Drive Ports Active)	Green	**FLASHING:** Activities on the drive side. **OFF:** No activities on the drive side.
4	**N/A**	N/A	**N/A**
5	**C_Dirty** (Cache Dirty)	Amber	**ON:** Indicates that data is currently being cached in memory or is being held up by the BBU during a system power loss.
6	**BBU Status**	Amber	**ON:** Indicates the BBU has failed and cannot sustain cached data. **OFF:** Indicates the BBU can sustain cached data in memory. **FLASHING:** The BBU is charging. **(NOTE:** The BBU is considered as an optional module. If a BBU has not been installed, then this LED is always off).

Table 3-2: Controller Module LED Definitions

3.2.2.1 FC Controller Module LEDs

The FC controller modules have additional two (2) LEDs, labeled A and B. The definitions of these LEDs are shown in ***Table 3-3*** below.

LED	Name	Color	Status
A	**CH0 LINK**	Green	**ON** indicates that channel 0 link has been established. **OFF** indicates that channel 0 link has not been established.
B	**CH1 LINK**	Green	**ON** indicates that channel 1 link has been established. **OFF** indicates that channel 1 link has not been established.

Table 3-3: FC Port Link Status LEDs

3.2.3 LAN Port LEDs

Both the 8bay ans 12 bay Galaxy subsystems come with a RS-232C audio jack serial port that can be used to assign a permanent IP to the subsystems. After a permanent IP address has been assigned, an Ethernet cable can be used to connect the RJ-45 Ethernet port to a network hub or router. This enables you to manage your subsystem locally or remotely over TCP/IP. See ***Figure 3-2*** for the locations of the two LED indicators on Ethernet port. Refer to ***Table 3-4*** for the LED definitions.

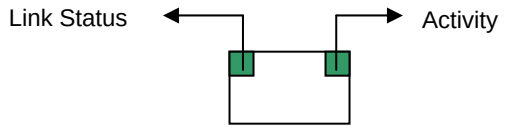

Figure 3-2: LAN Port LEDs

LED Name	Color	Status
Link Status	Green	**ON:** Indicates a valid connection to network
LAN Activity	Green	**BLINKING:** Indicates active transmissions

Table 3-4: Ethernet Port LED Definitions

3.2.4 LCD Keypad Panel

The front panel LCD panel comes with three (3) status-indicating LEDs. The LEDs on the front panel are marked, from top to bottom, **PWR**, **BUSY**, and **ATTEN**, as shown in ***Figure*** *3-3* below. The definitions of these LEDs are shown in ***Table*** *3-5*. The mute button can be used to stop the alarm until the next controller event occurs.

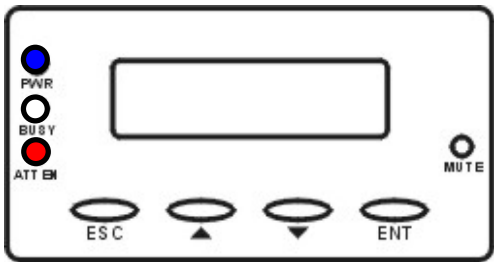

Figure 3-3: LCD Keypad Panel

LED Name	Color	Status
PWR	**Blue**	**ON** indicates that power is being supplied to the subsystem. **OFF** indicates that no power is being supplied to the subsystem.
BUSY	**White**	**Flashing** indicates that there is activity on the host/drive channels. **OFF** indicates that there is no activity on the host/drive channels.
ATTEN	**Red**	**ON** indicates that one or more component failure/critical events have occurred. **OFF** indicates that the subsystem and all its components are operating correctly.

Table 3-5: LCD Panel LED Definitions

NOTE:

The LCD panel ATTEN LED will, during the power up process, be turned on. If the subsystem boots up correctly, then the ATTEN LED will be turned off after the boot up procedure is complete.

3.2.5 Drive Tray LEDs

The drive trays come with two (2) status-indicating LEDs, one that indicates power and the other that indicates hard drive activity. The LEDs are shown in ***Figure** 3-4* and their definitions in ***Table** 3-6*.

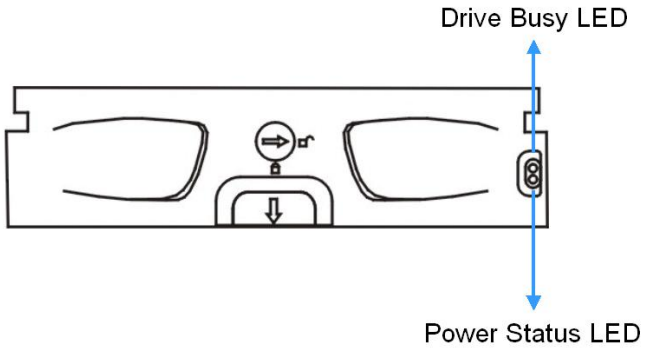

Figure 3-4: Drive Tray LEDs

LED Name	Color	Status
Drive Busy	**Blue**	**FLASHING** indicates there is read/write activity on the drive. **OFF** indicates there is no read/write activity on the drive.
Power Status	**Green/Red**	**GREEN** indicates that power is being supplied to the drive. **RED** indicates that the drive has failed

Table 3-6: Drive Tray LED Definitions

3.2.6 PSU Module LED

The PSU module has one (1) LED located just above the power switch and just below the retention screw. (See ***Figure** 3-5*) The LED indicates the operational status of the PSU module. Please refer to ***Table** 3-7* for PSU LED definitions.

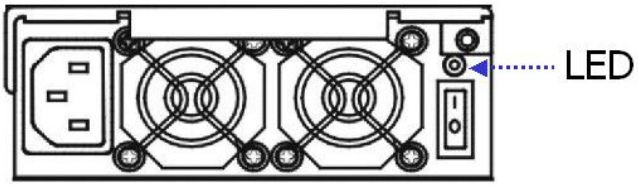

Figure 3-5: PSU Module LED

Color	Status
Flashing Green	The power supply has not been turned on. The PSU module LED will blink when the subsystem is connected to a power source but has not been turned on.
Static Green	The PSU is operating normally and experiencing no problems
Static Red	The PSU has failed and is unable to continue providing power to the subsystem.
OFF	The power cord is unplugged or the power cord is plugged but no power is being supplied from the power source.

Table 3-7: PSU Module LED Definitions

3.2.7 Cooling Module LED

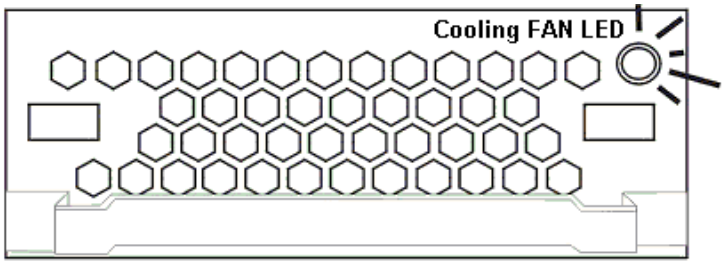

Figure 3-6: Cooling Module LED

Each cooling module has one (1) red LED on the back. Each LED corresponds to a single fan within the cooling module. (See ***Figure** 3-6* for the LED's location)

RED	Status
OFF	The respective cooling fan is operating normally.
ON	The respective cooling fan has failed and the module must be replaced.

Table 3-8: Cooling Module LED Definitions

3.2.8 BBU Module LED

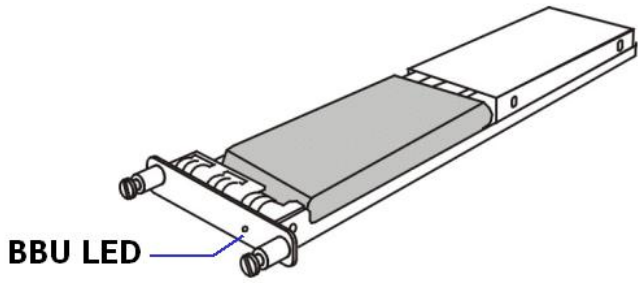

Figure 3-7: Battery Module LED Location

Yellow	Status
ON	Battery failed.
OFF	Battery operating normally.
Flashing	Battery is charging.

Table 3-9: Battery LED Definitions

3.3 Audible Alarm

Different subsystem environmental and operational parameters (such as temperature, etc.) have been assigned a range of values between which they can fluctuate. If either the upper or lower thresholds are exceeded, an audible alarm will automatically be triggered. The alarm will also be triggered when an active component of the subsystem fails. If the subsystem manager is onsite and is alerted by the alarm, the manager needs to read the error message on the LCD screen or on the PC terminal to determine what has triggered the alarm. After determining what has occurred, the subsystem manager must take appropriate actions to rectify the problem.

WARNING!

Whenever an alarm is triggered, you must determine the problem. If the audible alarm is ignored or not taken seriously and the problem is not rectified, permanent damage to the system can result.

3.3.1 Default Threshold Values

Table 3-10 shows the default threshold values for the subsystem. If any of these values are surpassed, the alarm will sound:

Parameter	***Upper Threshold***	***Lower Threshold***
Enclosure Ambient Temperature	40ºC	0ºC
+3.3V	+3.6V	+2.9V
+5V	+5.5V	+4.5V
+12V	+13.2V	+10.8V
CPU Temperature	90ºC	5ºC
Board Temperature	90ºC	5ºC

Table 3-10: Default Threshold Values

The thresholds in ***Table 3-10*** are the default threshold values. Except the "Enclosure Ambient Temperature," the user can change the rest of the values. To see how to change these values, please refer to the ***Generic Operation Manual*** that came with your system.

Note that the trigger point on temperature for raising the rotation speed of cooling fans is pre-adjusted according to environment tests and might not coincide with the temperature thresholds.

3.3.2 Failed Devices

If any of the following devices fail, the audible alarm will be triggered:

- Cooling modules
- PSU modules
- BBU module
- Hard drives
- Components on the RAID controller

3.4 I^2C Monitoring

Module presence detection and the general working status of cooling fan and other modules are monitored through an I^2C serial bus. If any of these modules fails, the failure will be detected and you will be notified via the various methods described above.

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Chapter 4
Subsystem Connection and Operation

This chapter introduces sample topologies, configuration options and server connections for the Galaxy subsystems and discusses both the power on and power off procedures.

4.1 FC Host Connection Prerequisites

NOTE:

*The topics covered in **Section** 4.2 only pertain to the FC models.*

4.1.1 Cabling

The FC Standard allows for optical connections. Optical cables can be used over long distances, have been shown to be more reliable, and are less susceptible to EMI. Due to the extremely high data transfer rates, Fiber-optic cables are preferred for 4Gbps FC connectivity.

WARNING!

All cables must be handled with care. To prevent interference within a rack system, the cable routing path must be carefully planned and they must not be bent.

4.1.2 FC Lasers

WARNING!

*Lasers can be hazardous and may cause permanent eye damage or blindness, and therefore must be carefully handled and used with caution. **Never look at lasers without knowing whether they are on or off.** Carefully read the associated warning messages that shall be provided with the SFP transceivers you purchase.*

Wavelengths: The lasers on FC fiber optic cables emit either short wave (SW) beams (770nm - 860nm) or long wave (LW) (1270 nm - 1355 nm) beams. Depending on the transceiver type you selected, cables using either of these wavelengths can be used.

Laser types: Two (2) types of laser devices can be used in FC cables: Optical Fibre Control (OFC) and non-OFC lasers. The OFC lasers are high-powered and can be used over long distances.

Safety features: Due to their high power output, OFC lasers usually come with a safety mechanism that switches the laser off as soon as it is unplugged. Non-OFC lasers are low power and do not come with these safety features; however, they can still inflict damage.

4.1.3 SFP Transceivers

On the subsystem's host ports, electric signals are converted by SFP transceivers into laser light pulses. FC cables connect the subsystem's host ports through SFP transceivers. These transceivers should typically have at least 4Gbps bi-directional data links, a laser transmitter (for fiber optic cables), an LC-type connector, compatibility with multi-mode cables, and a metal enclosure to lower the EMI.

NOTE:

LC connectors are small form-factor, fiber-optic connectors based on a 1.25-mm ceramic ferrule with the latching mechanisms of modular plug and jack.

Other beneficial features for a typical SFP transceiver include a single power supply, low power dissipation, and hot-swap capability. It is also important that any transceiver you use meets the FC performance and reliability specifications.

NOTE:

SFP modules must be purchased separately. A variety of FC cables and transceivers can be used. Please purchase the correct SFP modules from your subsystem vendor/distributor and contact them for the latest list of certified modules.

4.1.4 Fibre Channel Topologies

The Fibre Channel Standard has been designed to support Fibre Channel arbitrated loop (FC-AL).

- **FC-AL**: This is the most common topology currently in use. Fibre Channel devices are all connected in a loop. Each device is assigned an arbitrated loop physical address (AL_PA). The FC-AL supports 127 devices in a single loop.

All ***GHDX-2422S-8F4D*** and ***GHDX-2422S-12F4D*** subsystems support the above topology.

4.1.5 Points of Failure

The primary concern for configuring host-side topologies is that ***points of failure*** are avoided. It is therefore recommended that the host side be connected to at least two (2) HBAs. By-pass circuitry should be provided outside the subsystem; therefore, it is also preferable to connect the FC RAID subsystems to the host computer(s) through FC-4G Fibre switches.

NOTE:

To create dual-redundant data paths on the host side, it is necessary for third-party failover software on the host computer to re-direct data flow in the event of single path failure.

4.1.6 Sample Topology – Clustered Hosts

In the configuration shown in ***Figure 4-1,*** one (1) subsystem is connected to two (2) clustered servers. Data path redundancy makes sense when the following configurations are available:

1. These two computers are clustered.
2. HA access software control is available.
3. The same storage volume(s) are made available on both host ports. The surviving computer can access the array in the event of single computer failure.

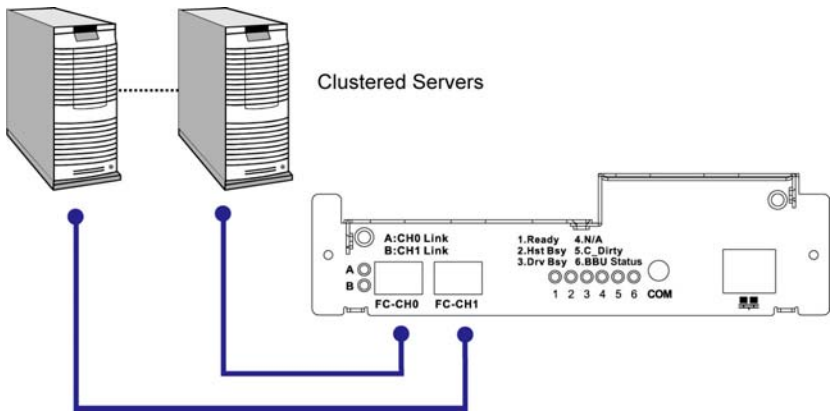


Figure 4-1: Sample Topology Including Clustered Servers and One Subsystem

- ***Connections:*** The input ports on the subsystem, ***FC-CH0*** and ***FC-CH1***, are connected to two separate host computers.

- ***Redundant Data Paths:*** In the configuration shown in ***Figure 4-1,*** the data paths are redundant. If either of these data paths fails, I/O traffic will be transmitted along the alternative path. If one of the host computers fails, the second host computer that is connected to the subsystem can resume the operation of the subsystem.

NOTE:

To create dual-redundant data paths on the host side, it is necessary for third-party failover software to be installed on the host computer.

4.1.7 Sample Topology – Direct-Attached

In the configuration shown in ***Figure 4-2,*** one (1) subsystem is connected to a single host computer. Data path redundancy makes sense when the following configurations are available:

1. HA access software control is available.
2. Storage volume(s) are presented on either of the host ports. The host management software should direct all data flow through a surviving path in the event of single path failure.

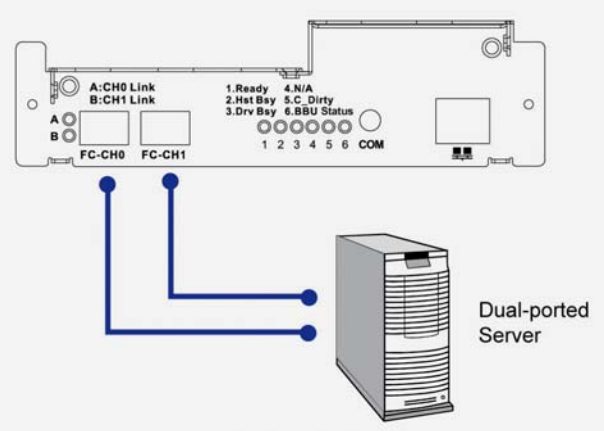


Figure 4-2: Sample Topology Includes Single Host and One Subsystem

- ***Connections:*** The input ports on the subsystem, ***FC-CH0*** and ***FC-CH1***, are connected to two separate HBAs on a server.

- ***Redundant Data Paths:*** In the configuration shown above**,** the data paths are redundant. If either of these data paths fails, I/O traffic will be transmitted along the alternate path.

4.1.8 Sample Topology – Data Sharing

In the configuration shown in ***Figure 4-3,*** many servers share one (1) subsystem over the Fibre Channel network. Data path redundancy makes sense when the following configurations are available:

1. HA access software control is available or that each storage volume is exclusively accessed through one ID/LUN on a host port.
2. Multiple storage volumes can each be optimized for a different kind of I/O demands. Logical drive stripe size and write policy can separately be configured
3. Multiple Storage volumes are presented on either of the host ports. The host management software should direct the data flow through a surviving path in the event of single path failure.

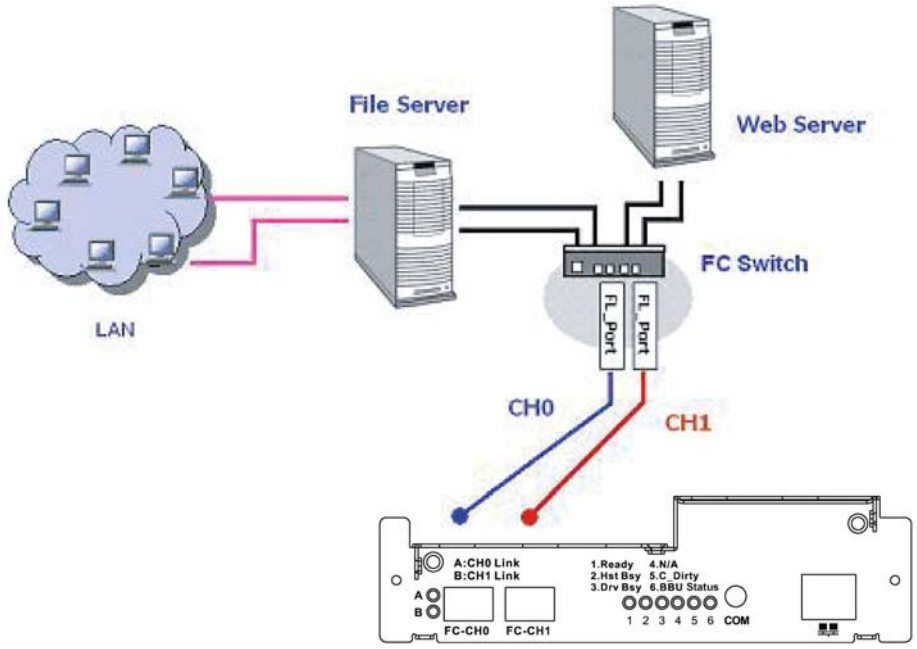


Figure 4-3: Sample Topology for Data Sharing

- ***Connections:*** The input ports on the subsystem, ***FC-CH0*** and ***FC-CH1***, are connected to a FC switch and then to HBAs on host computers.

4.2 Power On

Once all the components have been installed in the Galaxy subsystem, the host channels have been connected to the host, power on the FC networking devices (e.g., FC switches), the subsystem, and then power on the host computer(s).

4.2.1 Check List

BEFORE powering on the Gaxy subsystem, please check the following:

☐ ***Memory Modules*** – Memory modules have been correctly installed on the controller boards.

☐ ***BBU Modules*** – If used, that the BBU modules have been installed correctly.

☐ ***Hard Drives –*** Hard drives have been correctly installed on the drive trays.

☐ ***Drive Trays*** – **ALL** the drive trays, whether or not they have a hard drive, have been installed into the subsystem.

☐ ***Cable Connections –*** The host ports on the subsystem have been correctly connected to a host computer.

☐ ***Power Cables –*** The power cables have been connected to the PSU modules on the subsystem and plugged into main power.

☐ ***Ambient Temperature*** – All the subsystem components have been acclimated to the surrounding temperature.

4.2.2 Power On Procedure

When powering on the Galaxy subsystem, please follow these steps.

1. ***Power on the Fibre Channel networking devices.***

   These devices include the FC switches, and any other such device that have been connected to the subsystem. Please refer to the documentation that came with your FC devices to see the power on procedure.

2. ***Power on the subsystem.***

   The subsystem should only be powered on after all the Fibre Channel connection devices have been powered on first. The subsystem power on procedure is described below.

3. ***Power on the host computers.***

   The host computers should be the last devices that are turned on. Please refer to the documentation that came with your host computers to see their own power on procedures.

4.2.3 Power On Enclosure

To power on the subsystem, turn on the two power switches located on the rear of the subsystem. (See ***Figure 4-4***) Each switch controls a single PSU, therefore make sure that both switches are turned on.

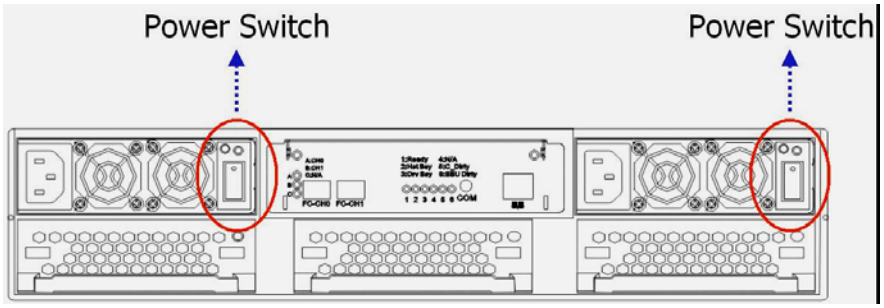


Figure 4-4: Galaxy Subsystem Power Switches

CAUTION!

Although the PSUs are redundant and a single PSU can provide sufficient power to the subsystem, it is advisable to turn both of the power switches on. If only one PSU is operating and fails, system operation will be terminated.

4.2.4 Power On Status Check

Once the subsystem has been powered on, the status of the entire subsystem should be checked to ensure that everything is running smoothly and that there are no complications or malfunctions.

☐ ***Controller Module LEDs*** – The *controller ready*, *FC Host Ports Active*, and *SATA Device Ports Active* LEDs should all flash green.

☐ ***Drive Tray LEDs –*** The green LED for all the drive trays (that contain hard drives) should light up, showing that there is power.

☐ ***LCD Panel LEDs –*** The blue LED on the LCD panel should come on, indicating that power is being supplied to the system.

- ***Firmware and RAIDWatch*** – The overall status of the system may be checked using the pre-installed firmware or the RAIDWatch GUI.

- ***Audible Alarm*** **-** If any errors occur during the initialization process, the onboard alarm will sound in a hastily repeated manner.

Drive tray LEDs should normally start flashing, indicating the RAID control units are attempting to access the hard drives.

NOTE:

The subsystem has been designed to run continuously. Even if a component failure occurs the fault can be corrected online.

4.2.5 LCD Screen

When powering on the subsystem, the following messages should appear on the front panel LCD screen. Wait for the front panel LCD to show "**READY**" or "**No Host LUN**" before the host boots up. Refer to ***Figure 4-5*** on how to read the screens.

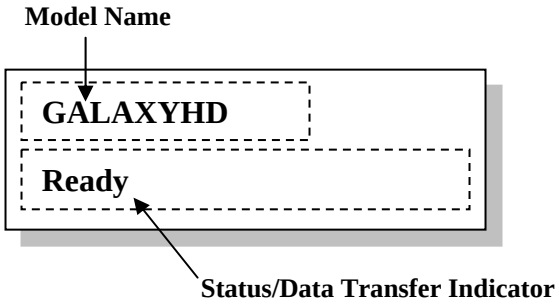
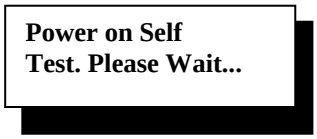


Figure 4-5: The LCD Initial Screen

The LCD screen startup sequence is shown and described in the sequence below.

This screen appears when the PSUs are turned on.



System is performing a self test.

4.3 Power Off Procedure

To power down the Galaxy subsystem, please follow these steps:

NOTE:

When powering down the Galaxy subsystem, please ensure that no time-consuming processes, like a "Logical Drive Parity Regeneration" or a "Media Scan," are taking place.

1. ***Stop I/O access to the system.***

   Stop all I/O accesses to the Galaxy subsystem and host applications. Please refer to the related documentation for your applications.

2. ***Flush the cache.***

Use the Shutdown Controller function to flush all cached data. This prepares the RAID subsystem to be powered down.

3. ***Turn off the power.***

   Turn off the power switches at the top of the rear panel of the Galaxy RAID subsystem. Once the RAID subsystem has been powered down, other devices connected to the subsystem may be powered down.

Chapter 5

Subsystem Maintenance and Upgrading

5.1. Overview

5.1.1 Maintenance

Constant monitoring and maintenance of your SATA-based subsystem will minimize subsystem downtime and preserve the working integrity of the system for a longer period of time. If any of the subsystem components fail, they must be replaced as soon as possible.

WARNING!

Do not remove a failed component from the subsystem until you have a replacement on hand. If you remove a failed component without replacing it, the internal airflow will be disrupted and the system will overheat causing damage to the subsystem.

All of the following components can be replaced in case of failure:

1. Controller modules – ***Section 5.2***
2. Memory Module – ***Section 5.3***
3. BBU Modules **- *Section 5.4***
4. PSU modules – ***Section 5.5***
5. Cooling modules – ***Section 5.6***
6. Hard drives – ***Section5.7***

5.1.2 General Notes on Component Replacement

- With the exception of the RAID controller module, all of the components on the subsystem, including the PSU modules, cooling modules, BBU, and drive trays, are hot-swappable and can be changed while the subsystem is still in operation

- Qualified engineers who are familiar with the subsystem should be the only ones who make component replacements. If you are not familiar with the subsystem and/or with RAID subsystem maintenance in general, it is strongly advised that you refer subsystem maintenance to a suitably qualified maintenance engineer.

- Normalized airflow is directly dependent upon the presence of all subsystem components. Even if a subsystem component fails, it should not be removed from the subsystem until a replacement is readily at hand and can be quickly installed. Removing a subsystem component without replacing it can lead to permanent subsystem damage.

- When replacing any hot-swappable component, caution should be taken to ensure that the components are handled in an appropriate manner. The rough or improper handling of components can lead to irreparable damage.

- When removing a controller module from the subsystem, ensure that the power has been turned off and that all precautionary measures, without exception, are adhered to. The controller board is very sensitive and can be easily damaged.

WARNING!

*When inserting a removable module, take heed that **DONOT USE EXCESSIVE FORCE**! Forcing or slamming a module can damage the pins on the module connectors either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more force to ensure the module connectors are correctly mated. If the module comes with extraction levers or retention screws, use them to secure the module.*

5.2. Replacing Controller Module Components

5.2.1 Overview

The controller module should never be removed unless the following replaceable components need to be accessed:

- DIMM Module: The DIMM module must be replaced when the DIMM module fails or if a larger capacity DIMM module is required.
- Controller Module itself: If the controller module in a single-controller configuration fails, it is necessary to power the system down and replace the controller.

If a DIMM module or RAID controller fails, contact you vendor immediately for a replacement. To replace any of these components, the controller module must first be removed from the subsystem.

5.2.2 Notes on Controller Module Maintenance

- The controller module contains a DIMM module. It is not recommended to re-use the DIMM module extracted from a failed controller unless you have a similar RAID subsystem that can be used to test the module.
- We provide a three-year warranty for subsystem components. You can contact your vendor for sending the failed controller in for repair.
- When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the subsystem. All previously stipulated safety precautions (see ***Chapter 2***) must be strictly adhered to. Failure to adhere to these precautions can result in permanent damage to the controller board, resulting in timely delays.
- For your own safety and that of the subsystem, make sure that no power is being supplied to the system prior to replacing the controller module.

5.2.3 Removing the Controller Module

To remove the controller module:

Step 1. Stop host I/Os or host applications to avoid losing data or causing data inconsistency.

Step 2. ***Turn off the subsystem***. If possible ***power off*** the subsystem in the way described in ***Chapter 4***. If it is not possible to do this ***turn off*** both PSU modules and disconnect the power cords.

Step 3. ***Disconnect all cables*** that are connected to the controller module you wish to replace. These include the cables connecting to the host, an Ethernet cables connected to the LAN port, and any cables connected to the RS-232C audio jack.

Step 4. ***Loosen the hand screws***. Hand screws are located on both sides of the RAID controller faceplate. Press these screws and loosen them so that the controller can be removed from chassis.

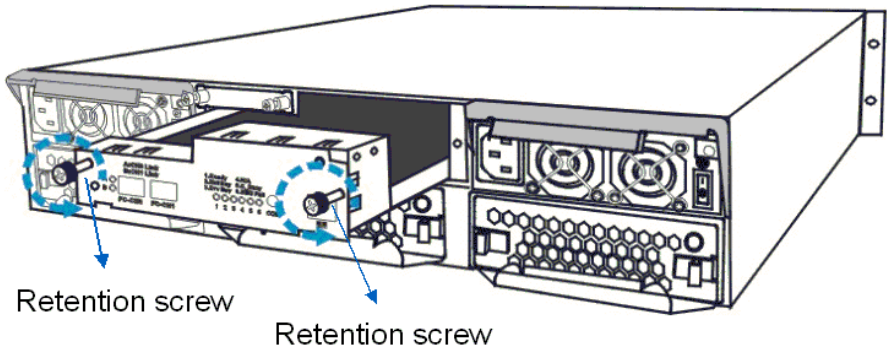


Figure 5-1: Loosening Hand Screws

Step 5. ***Pull the controller module out:*** Once the retention screws have been removed; gently pull the controller module out of the subsystem chassis.

5.2.4 Replacing the Controller Module

If the controller module has failed, it must be replaced. To replace a failed controller module:


Step 1. ***Remove the failed controller module***. (See Section 5.2.3)


Step 2. ***Install a DIMM module on the new controller module***. (See ***Section 5.3***)


Step 3. ***Insert the replacement controller***. Align the controller module with the module bay at the rear of the subsystem. Gently slide the controller module in.


Step 4. ***Fastening the hand screws***. Once fully inserted secure the controller module to the subsystem by fastening the two hand screws on both sides of the module.


Step 5. ***Re-attach all the cables*** that were removed. These include the cables that connect to the hosts, the Ethernet cable that was previously attached to the LAN port, and the cable that was attached to the RS-232C audio jack connector.


Step 6. ***Power on:*** Once the new controller module has been properly installed and the cables have been correctly connected, turn the subsystem power on.

5.3. Replacing or Upgrading Memory Modules

5.3.1 Memory Module Installation Overview

The subsystem comes with a pre-installed 256MB (or above) DDR RAM DIMM module on the controller. The controller supports a memory module up to 2GB in size. If DDR RAM DIMM modules with a different size need to be used or the original memory module is damaged in some way, the pre-installed modules must be removed and the new ones installed. Replacement and installation instructions are described fully below.

The DIMM module is located on the controller board. The controller board is a sensitive component and must be treated with care to avoid being damaged.

WARNING!

The controller board in the controller module contains sensitive components. Please ensure that all anti-static precautions stipulated above are strictly adhered to. Only qualified engineers should replace the DIMM module.

5.3.2 Selecting a Memory Modules

If the memory module mounted on the controller is going to be replaced, the following factors must be considered when purchasing replacement DIMM modules:

- ***Pre-installed DIMM module:*** The subsystem comes with a 256MB DDR RAM DIMM module pre-installed on the controller board. If you wish to change the size of the DIMM, then a new, separately purchased DIMM must be installed.

- ***DDR RAM DIMM modules supported***: The subsystem supports DDR RAM DIMM modules with memory capacities from 256MB to 2GB.

- ***Installation considerations:*** When installing the DIMM module, it is necessary to handle the controller module. The controller board is more susceptible to damage than the other components and must therefore be handled with extreme care. ALL anti-static precautions specified in ***Section 2.3*** must be strictly adhered to.

- ***Secure installation***: When replacing the DIMM module, make sure that the new DIMM module is firmly in place prior to installing the controller module. If the DIMM module is not firmly in place, the subsystem will not run and the controller will need to be removed and the DIMM module correctly installed.

- ***Purchasing considerations***: When purchasing a DDR RAM DIMM to install on the controller board, contact your vendor for an updated list of certified modules.

5.3.3 DIMM Module Installation

WARNING!

The pre-installed modules must be removed prior to installing new memory modules. Do this with care. Sensitive components can be damaged during the process.

Step 1. ***Remove the controller module***. See Section 5.2.3.

Step 2. ***Remove the previously installed DIMM module from the DIMM socket***. To do this, push the white clips on either side of the DIMM module down. By doing this, the previously installed modules will be ejected from the DIMM socket. (See ***Figure 5-2***)

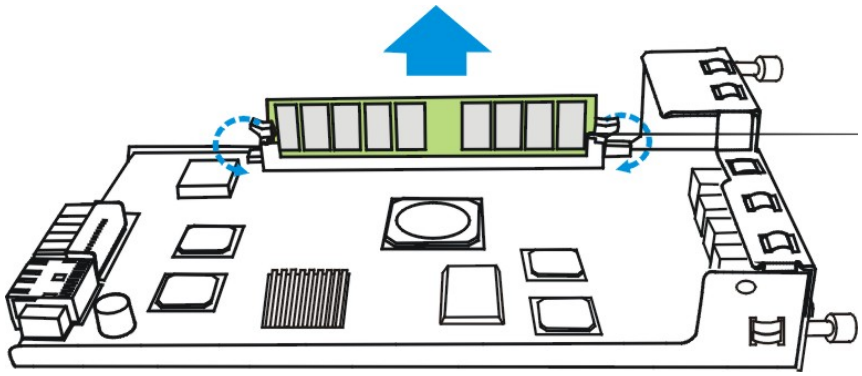


Figure 5-2: Push Back the White Clips on the Sides of the DIMM Module

Step 3. ***Gently retrieve the DIMM module out of the DIMM socket.*** (See Figure 5-2)

Step 4. ***Insert the DIMM module into the DIMM socket***. Align the DIMM module with the DIMM socket. Once aligned, gently push the DIMM module into the socket. The white clips on the sides of the socket will close automatically and secure the DIMM module into the socket.

Step 5. ***Reinstall the controller module***. After the DIMM module has been properly installed, the controller module must be reinstalled. Align the controller module with the controller module bay. Then gently push the controller module in the controller bay. Carefully push the controller until you feel the contact when the board edge connectors are mated to the backplane. Do not use force. If unusual contact resistance is felt, try it again. Next secure the controller module into the subsystem by fastening the hand screws on the sides.

NOTE:

When replacing a DIMM, the whole subsystem needs to be powered down. Therefore, when replacing a DIMM, you should carefully select the time when the replacement will be made in order to minimize the overall disruption to service.

5.4. Replacing a Faulty BBU

IMPORTANT!

The BBU is hot-swappable, can be replaced while the subsystem is running. However, a new module will only be recognized after a subsystem reset. Carefully select the time when the reset will be made in order to minimize the overall disruption to service.

To replace a faulty BBU, please follow these steps:

Step 1. ***Remove the faulty BBU module from the chassis***. The BBU module is secured to the chassis with two (2) spring screws. These screws must be loosen. To loosen, turn the screws counterclockwise. (See ***Figure 5-3***)

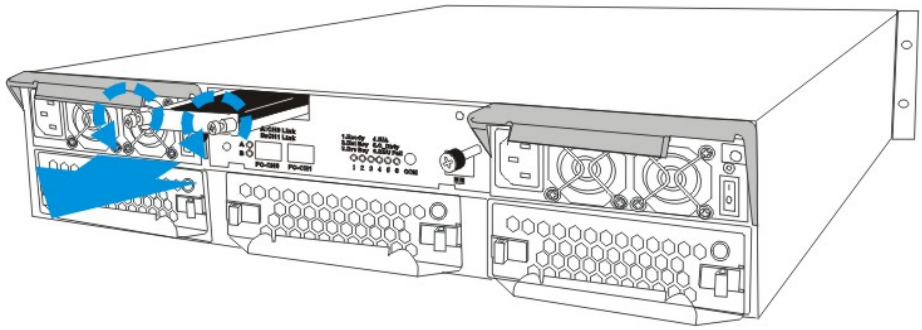


Figure 5-3: Remove the BBU Module

Step 2. ***Install the new BBU module***. After the faulty BBU module has been removed, the new BBU module can be installed. To do this, align the BBU module with the empty slot, and then gently push the BBU module into the slot. (See ***Figure 5-4***)

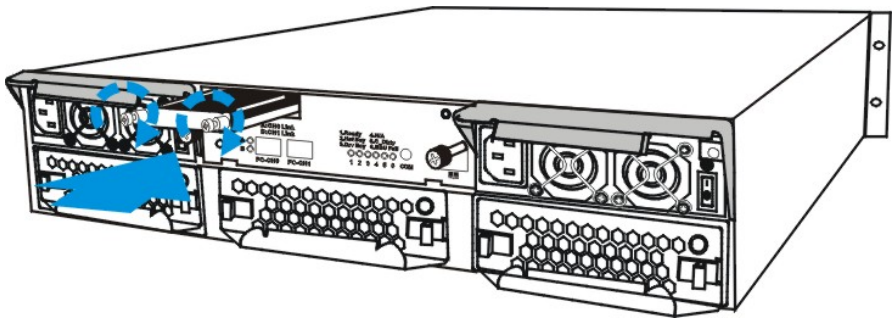


Figure 5-4: Install the BBU Module

Step 3. ***Secure the BBU module to the enclosure***. Tighten the two (2) spring screws as shown above on the back of the BBU module.

Step 4. Once the new BBU module is correctly installed into the subsystem, the LED should start flashing, indicates the BBU is being charged. When the BBU is fully charged, the LED will go off.

5.5. Replacing a Failed PSU Module

5.5.1 Notes on PSU Module Maintenance

- ***Two redundant PSU modules***: The subsystem comes with two fully redundant, hot-swappable PSU modules. These modules are accessed from the rear of the subsystem.

- ***Immediate replacement***: When a PSU fails, it should ideally be replaced immediately. Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement will cause severe disruptions to the internal airflow and the subsystem will overheat, possibly causing irreparable damage to some of the subsystem components.

WARNING!

Although the subsystem can operate using single PSU module, it is not advisable to run the Rorke Data subsystem with a single PSU module for an extended period of time.

5.5.2 Replacing the PSU Module

WARNING!

Before you insert a new PSU, be sure that it has the same warning label on its retention lever as that shown on the lever of a remaining PSU. Double-check to avoid mixing a PSU of a different Galaxy series.

To replace a PSU, please follow these steps:

Step 1. ***Turn off the PSU***. The power switch is located at the top of the rear panel, directly above the PSU module. (See ***Figure*** 5-5)

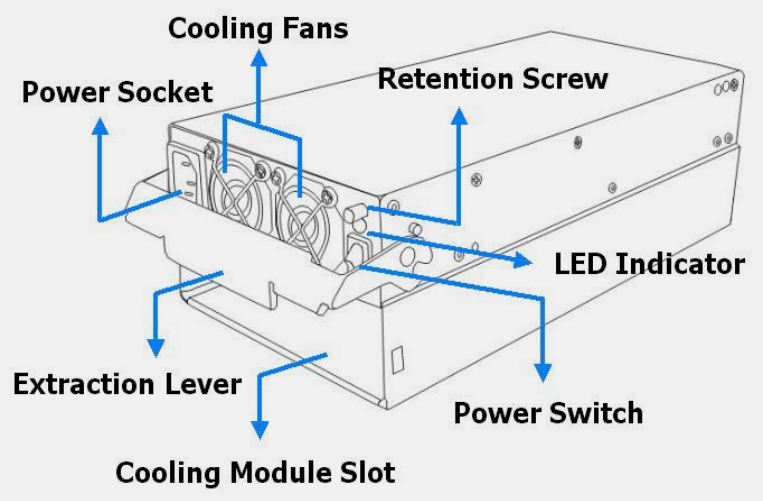


Figure 5-5: PSU and Cooling Module Components

Step 2. Once the power switches have been turned off, ***remove the power cable*** that connects the Galaxy subsystem to the main power. The power cable socket is found on the left-hand side of the module.

Step 3. ***Remove the retention screw:*** After the power cable has been removed from the power connector, remove the retention screw at the upper right side of the PSU rear-end panel. The screw is located below the extraction lever, beside the LED indicator, and can be hidden from sight. (See ***Figure 5-6***.)

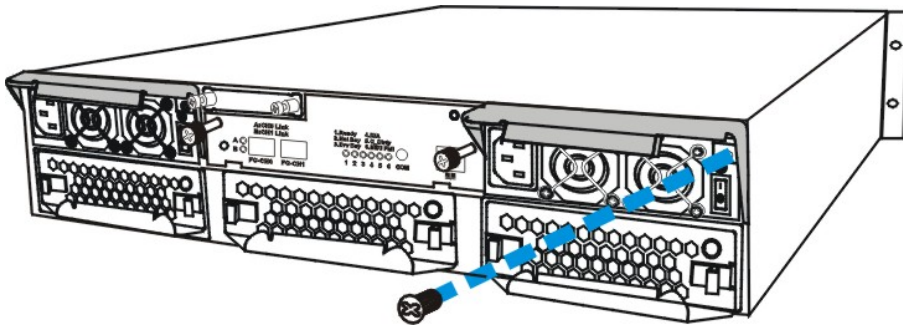


Figure 5-6: Removing the PSU Retention Screw

Step 4. ***Remove the PSU module***. Push the lever at the back of the PSU module downwards. This will dislodge the PSU module from the subsystem. Once dislodged gently pull the PSU module out of the subsystem. (See ***Figure 5-7***)

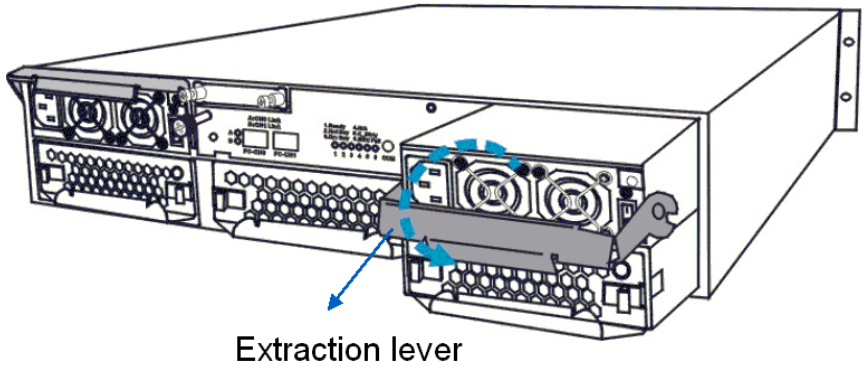


Figure 5-7: Removing the PSU Module

Step 5. ***Pull the extraction handle downward:*** Pull the extraction lever at the back of the PSU module downwards. This will dislodge the PSU module from the subsystem. Once dislodged, gently pull the PSU module out of the subsystem.

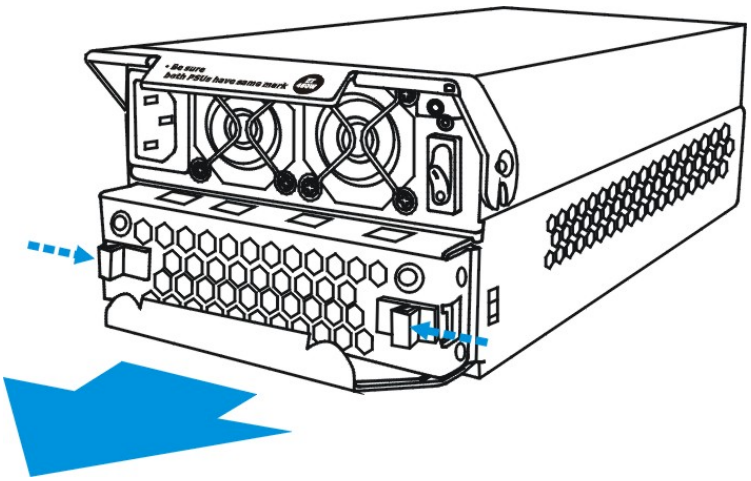


Figure 5-8: Remove the Cooling Module

WARNING!

- *When a PSU is pulled out of the chassis, the fan module beneath the PSU is removed from the chassis at the same time.*
- *Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement will cause severe disruptions to the internal airflow and the subsystem will overheat, possibly causing irreparable damage to some of the subsystem components.*
- *It is recommended that the replacement procedure is completed in less than five (5) minutes to prevent the subsystem from overheating.*

Step 6. ***Remove the cooling module:*** To do this, push the clips on either side of the module rear panel together. Then gently pull the cooling module out of the lower level of the PSU bracket.

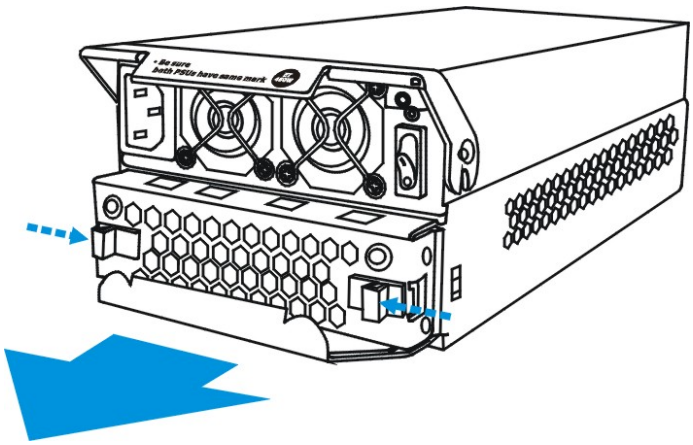


Figure 5-9: Remove the Cooling Module

Step 7. ***Reinstall the cooling module into the new PSU module:*** To do this, align the cooling module with the lower level of the PSU bracket and gently slide the cooling module in.

Step 8. ***Insert the new PSU module into the subsystem:*** Once the previously removed cooling module has been installed, insert the new PSU module into the subsystem. Make sure the extraction lever is in its downright position so that the saddle notches on the lower edges of the handle can lock on to the edge metal brackets along the chassis inner walls. Push the PSU into the slot and pull the handle upwards to secure the module.

Step 9. ***Reinsert the retention screw:*** If the PSU module is properly installed, the back end of the module should be aligned with the enclosure's rear panel. To firmly secure the PSUs into place, reinsert the retention screw.

Step 10. ***Reconnect the power cord and turn the power on:*** Plug the power cord into the socket on the PSU module and turn the PSU module power switch on.

5.6. Replacing a Failed Cooling Module

5.6.1 Notes on Cooling Module Maintenance

- ***Two redundant cooling modules***: The subsystem is equipped with two (2, ***GHDX-2422S-8F4D***) or three (3, ***GHDX-2422S-12F4D***)redundant, hot-swappable, single-fan cooling modules located in the lower PSU module slot. These cooling modules control the internal operational temperature of the subsystem and therefore their working integrity should be maintained at all times.

- ***Detecting a failed cooling module***: If a cooling module fails, you can be notified of the failure by the LED located at the back of the module, an audible alarm, the firmware screen, the RAIDWatch Panel View, or through the various methods by the Configuration Client utility.

- ***Replacing a cooling module***: When you are notified that a cooling module has failed, it should be replaced as soon as possible. A failed cooling module should only be removed from the subsystem when you have a replacement module that can be installed as soon as the failed cooling module has been removed.

WARNING!

- *The latches at the back of the cooling module secure the cooling module into the enclosure. If these latches are broken, the warranty on the cooling module will be void.*
- *Although the cooling modules are fully redundant, it is not advisable to run the Galaxy subsystems with any of the cooling modules missing. Whenever a cooling module fails, the system is at risk of sustaining irreparable damage*
- *Keep a failed module in its enclosure bay until a replacement unit is in hand.*

5.6.2 Replacing a Cooling Module

The cooling modules are secured to the chassis with two black latches located on the rear of the module. To replace the cooling module, please follow these steps:

Step 1. ***Remove the cooling module***. Squeeze both side latches towards the center of the cooling module and gently withdraw the cooling module from the subsystem by gently pulling on the silver handle at the bottom. (See ***Figure 5-10***)

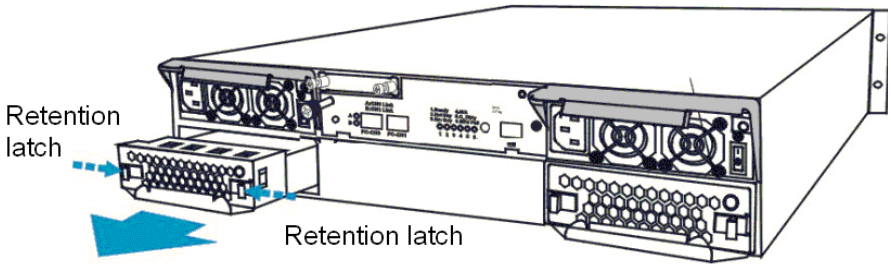


Figure 5-10: Removing the Cooling Module

WARNING!

Forcing or slamming a module into place can damage the connector pins on the module itself or that on the subsystem backplane.

Step 2. ***Install the new cooling module***. To do this, align the replacement cooling module with the bay from which the faulty one was removed. Then gently slide the new cooling module into the enclosure subsystem. The latches will hold the module in place.

5.7. Drive Tray Maintenance

5.7.1 Notes on Hard Drive Maintenance

- ***Hot-swappable drive trays***: The drive trays are all hot-swappable. If a hard drive fails, it can be replaced while the subsystem is still running.

- ***Forearm handles:*** If the hard drive is behind either the left or right forearm handle, make sure that the locking mechanism on the side of the handle is first released prior to opening the handle itself. (See ***Figure 5- 11***) The locking mechanism must also be released in order to close the handle. Therefore, after the new drive has been installed, it will be necessary to release the locking mechanism on the handle prior to closing it. For more information, please refer to ***Section 1.5*** in ***Chapter 1***.

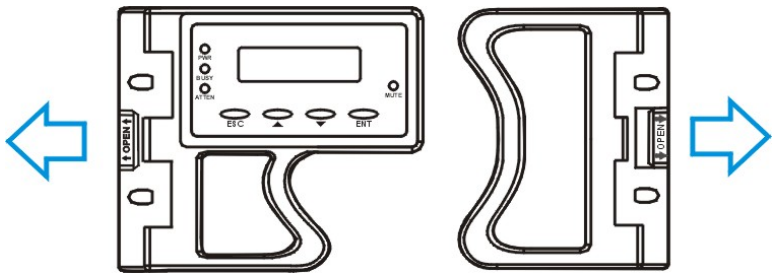


Figure 5- 11: Forearm Handle Locking Mechanism

- ***Front flap mechanism:*** Do not leave a drive tray's front flap open. The front flap and its key-lock secure a drive tray to chassis slot. A disk drive operating with the half-open front bezel may result in signal glitches and Data Compare Errors might ensue.

- ***Remove drives slowly***: When removing a drive tray, withdraw it from the enclosure slowly. If the drive tray is removed too quickly a drive I/O timeout will occur.

- ***Replacement on-hand***: Before removing a failed hard drive from the subsystem, make sure you have a replacement hard drive readily available. Do not leave the drive tray slot open for an extended period of time. If the drive tray slot is left unoccupied for an extended period of time, the normalized airflow will be disrupted and subsystem components will overheat and may become permanently damaged.

5.7.2 Replacing a Failed Hard Drive

To replace a hard drive, please follow these steps:

WARNING!

The hard drive is fragile; please always handle with extreme care. Do not drop the hard drive; always be slow, gentle and careful when handling a hard drive. Only handle the hard drive by the edges, avoid touching any components or connector pins.

Step 1. ***Identify the drive tray*** that contains the hard drive that needs to be replaced.

WARNING!

Replacing the wrong drive in an array can fatally fail a RAID configuration. You should identify a failed drive from the RAIDWatch GUI screen, by checking the drive slot ID in the terminal screen, by checking the LEDs on the drive tray panel, and/or use the identify/flash drive function in firmware. Please refer to ***Section 1.5*** *in your* ***Generic Operation Manual*** *for details on this function.*

Step 2. ***Open the front flap.*** To open the front flap, push the release button at the front of the tray bezel. (See ***Figure 5-12***) The front bezel will automatically be lifted and the drive tray will be dislodged from the chassis.

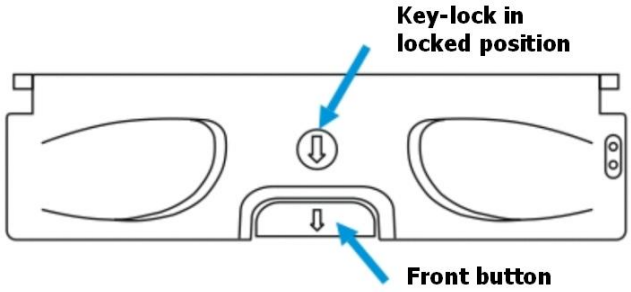


Figure 5-12: Front View of an Individual Drive Tray

Step 3. ***Remove the drive tray.*** To remove the drive tray from the enclosure, the key-lock must be unlocked. (See ***Figure 5-13***) To do this, turn the key-lock on the front of the drive tray until the groove on its face is in a horizontal orientation.

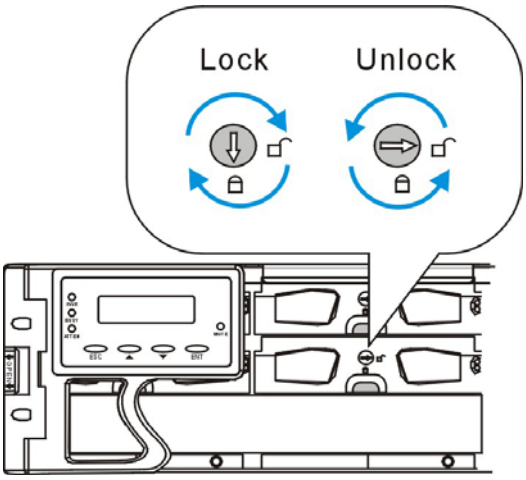


Figure 5-13: Drive Tray Key-Lock Rotation

Step 4. ***Remove the drive tray along with the hard drive.*** Once the drive tray is dislodged from the chassis, gently and carefully withdraw the drive tray with hard drive from the chassis.

Step 5. ***Remove the hard drive from the drive tray.*** The hard drive is secured to the drive tray with four (4) retention screws (two on each side.) To remove the hard drive, these retention screws must be removed. (See ***Figure 5-14***)

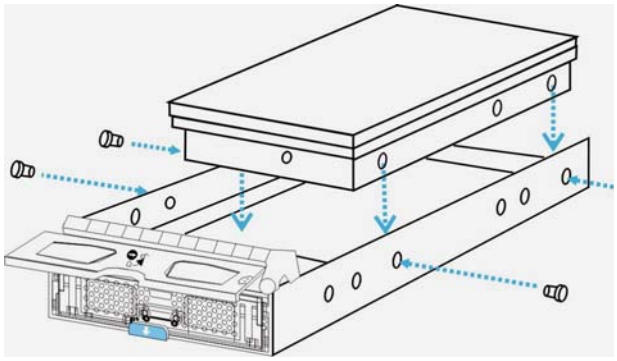


Figure 5-14: Removing the SATA Hard Drive

Step 6. ***Install the new hard drive:*** Please refer to the complete hard drive installation procedures in ***Section 2.9***.

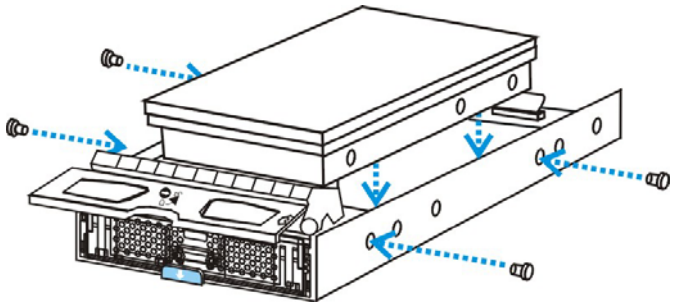


Figure 5-15: Removing the PATA Hard Drive

Step 6. If the failed drive is a member of a RAID 1, 3, or 5 array, once it is replaced the subsystem should immediately start to rebuild the array. The drive activity LEDs should start to flash. For more details about rebuilding a logical drive, you may refer to the Galaxy's ***Troubleshooting Standard Operation Procedures***.

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Appendix A

Specifications

A.1 Technical Specifications

Environmental Specifications	
Humidity	5 ~ 95% (non condensing – operating and non-operating)
Temperature	*Operating*: 0º to 40ºC *Non-operating*: -40º to 60ºC
Altitude	Sea level to 12,000 ft – Operating Sea level to 20,000 ft – Non-operating

Power Requirements	
Input Voltage	100~240VAC (auto-switching)
Frequency	47-63Hz
Power Consumption	350W

Dimensions	**w/o front handles**	**w/ front handles**
Height	88mm	88mm
Width	446mm	482mm
Length	490mm	505mm
Package dimensions	344H x 600W x 670D mm	

System Weight
Net weight: 23.5kg Gross weight: 25.0kg (without disk drives)

Certifications
• FCC Class-A • CE • UL60950 • CB • BSMI

Shock	
Half-sine	*Operating:* 5G peak, 11ms duration *Non-operating:* 15G, 11ms, half-sine

Vibration	
Operating	0.5oct/min
Non-operating	0.5oct/min

Warning Alarms
• LCD screen messages • Audible alarms • System LEDs ▪ Event notification via the RAIDWatch Manager (LAN broadcast, email, fax, MSN, SMS, and SNMP traps) and RS-232C terminal display

A.2 Controller Specifications

Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 10, 30, 50, JBOD, and non-RAID disk spanning
Host O/S Compatibility	Host O/S independent
Host Interface	FC-4G SFP sockets
Host Channels	2 FC-4G channels
Drive Interface	Supports 12 or 8 channel connections to 3Gbps SATA-II disk drives, SATA-I backward compatible
Drive Channels	All drive channels are pre-configured, routed through a back-end PCB and cannot be changed
Cache Mode	Write-through and Write-back
Cache Memory	Pre-installed 256MB (or above) DDR RAM DIMM with/without ECC, registered
Number of LUNs	Up to 32 per host ID
Multiple Target IDs/Host Channel	Yes
Aliases for Target IDs	Yes
Firmware on Flash Memory	Yes

Architecture

Specification	
CPU	IBM PowerPC 750FL-600
Fibre Controllers	HPFC-5750 (RoHS)
DIMM Slot	One 184-pin DIMM module
PC-133 Support	Yes
ASIC	64-bit chipset (GAL-500266)
Flash ROM	64Mbit (8MB)
NVRAM	32KB with RTC
Hardware XOR	Yes
Real-time Clock	For event messages with time record

A.3 Drive Tray Specifications

Specification	
Height	28mm
Width	110mm
Depth	218.92mm
Key Lock	Yes

A.4 Power Supply Specifications

Specification	
Nominal Power	350W
DC Output	12.0V: 25A 5.0V: 25A 3.3V: 20A
Input Frequency	47 ~ 63Hz
AC Input	100VAC @ 6A – 240VAC @ 3A with PFC
Power Factor Correction	Yes
Hold-up Time	At least 16ms at 100/240VAC full load after a loss of AC input
Over-temperature Protection	Auto shutdown when cooling is lost or elevated temperature is detected; over-voltage protection is also available.
Cooling Fans	Two fans for each unit (inside PSU)

A.5 Cooling Module Specifications

Specification	
Speed	High or low rotation speed controlled by firmware
Max. Air Flow (each module)	High speed: 31.8 CFM Low speed: 20.1 CFM
Input Power	9/3.12W max.
Rated Voltage	DC 12V
Temperature	Operating: -10 to +60ºC Storage: -20 to +70ºC

A.6 RAID Management

Specification	
Configuration	• LCD keypad panel • Text-based firmware-embedded utility over RS-232C connection through the included audio jack-to-DB-9 serial cable • The RAIDWatch Manager program using Ethernet connection
Performance Monitoring	Yes
Remote Control and Monitoring	Yes
Event Notification	Yes (via RAIDWatch's sub-modules, Configuration Client or NPC)
Hardware Connection	In-band over Fibre, Ethernet, or RS-232C
Configuration on Disk	Configuration data stored on disk drives for logical drive assemblies to exist after controller replacement; basic settings, e.g., channel mode settings, are stored on NVRAM
Failure Indicator	Via audible alarm, LCD keypad panel, RAIDWatch Manager session, event notifications, or event prompts on terminal emulation

A.7 Fault Tolerance Management

Specification	
SATA Drive SMART Support	Yes (with user-configurable detect only, clone and replace, and perpetual clone functions)
Battery Back-up Option	Yes
ISEMS (Simple Enclosure Management Service) via I^2C Interface	Yes
Automatic Drive Failure Detection	Yes
Automatic Rebuild on Spare Drives	Yes
Regenerate Logical Drive Parity	Yes
Bad Block Reassignment	Yes
Automatic Rebuild upon Failed Drive Replacement	Yes
Manual Clone of Suspected Failed Drive	Yes
Concurrent Rebuild on Multiple Drives in a RAID (0 + 1) Logical Drive	Yes
Salvage the 2nd Temporary Failed Drive in a RAID 1, 3 or 5 Logical Drive	Yes
Salvage the 1st Temporary Failed Drive in a RAID 0 Logical Drive	Yes

Appendix B

Spare Parts and Accessories

B.1 Spare Parts

Spare Parts Overview

Except the RAID controller module, all the active components in the subsystems can be replaced while the system is running. If any of these components fails then it can, if configured in a fully redundant mode, be hot-swapped. Spare parts for the subsystems can be ordered separately. This section lists the model names for the different spare parts.

Spare parts that come with the subsystem are listed in ***Table B-1***.

Model Name	Description
GALHDX-9273CDTray	Drive tray, type-III bezel and type-II LED lightpipe.
GALHDX-9272CPSU	Power supply module, 350W capacity.
GALHDX9272-CFanMod	Dual-speed version of cooling fan module:2U subsystems
GALHDX-9273CBTC	Battery cell pack, Li-ION battery cells
GALHDX-9272CHandR	Right-side forearm handle for 2U subsystems
GALHDX-9272CHandLLCD	Left-side forearm handle for 2U subsystems, an LCD keypad panel mounted on it

Table B-1: Spare Parts Shipped with the Subsystem

Controller Modules

Model Name	Description
GHDX/8-2422-FC4	Fibre-to-SATA RAID controller module, 2 x FC-4G host channels, 8 x SATA II drive channels.
GHDX/12-2422-FC4	Fibre-to-SATA RAID controller module, 2 x FC-4G host channels, 12 x SATA II drive channels.

Table B-1: Controller Module List

B.2 Accessories and Optional Items

Accessories Overview

A number of accessory items are available for the Galaxy subsystem. Some of these accessory items come with the subsystem; but if damaged or if more accessory items are needed, they can be ordered separately. Available accessory items are listed below:

Accessories that came with the subsystem are listed in ***Table B-2.***

Model Name	Description
GALHDX-9011	Null modem, DB-9 female to DB-9 male, wires swapped * One included in the shipping package
GALHDX-9270ASCab	RS-232C serial cable, audio-jack to DB9 * One included in the shipping package

Table B-2: Accessories Shipped with the Subsystem

Various Fibre Channel Switches, HBAs, and I/O cables are available to help complete your Fibre channel storage system. Contact inside sales at Rorke Data for your specific needs.

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Appendix C

Pinouts

C.1. SFP Connector Pinouts

Each of the SFP host or expansion ports is comprised of a case bottom, an EMI case, and a 20-pin host connector. These port sockets receive Small-Form-Factor (SFP) fiber optic transceivers. You may contact our technical support for an updated list of SFP transceiver modules that have been tested to comply with the sockets. The pinouts are shown in ***Figure C-1*** and their definitions are shown in ***Table C-1***.

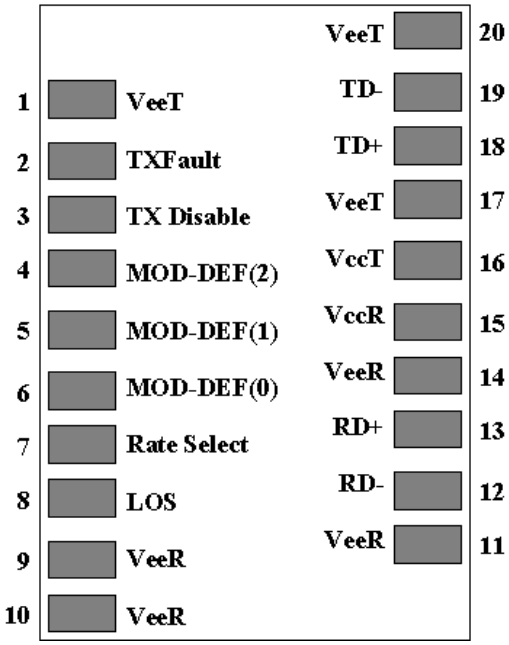

Figure C-1: SFP Connector Pinouts

Pin	Pin Name	Pin Description
1	V_{EET}	Transmitter ground (common with receiver ground)
2	T_{FAULT}	Transmitter fault; not supported
3	T_{DIS}	Transmitter disable; laser output disabled on high or open
4	MOD_DEF(2)	Module definition 2; data line for serial ID
5	MOD_DEF(1)	Module definition 1; clock line for serial ID
6	MOD_DEF(0)	Module definition 0; grounded within the module
7	Rate Select	No connection required
8	LOS	Indicates loss of signal; logic 0 indicates normal operation
9	V_{EER}	Receiver ground (common with transmitter ground)
10	V_{EER}	Receiver ground (common with transmitter ground)
11	V_{EER}	Receiver ground (common with transmitter ground)
12	RD-	Receiver inverted DATA out; AC coupled
13	RD+	Receiver non-inverted DATA out; AC coupled
14	V_{EER}	Receiver ground (common with transmitter ground)
15	V_{CCR}	Receiver power supply
16	V_{CCT}	Transmitter power supply
17	V_{EET}	Transmitter ground (common with receiver ground)
18	TD+	Transmitter non-Inverted DATA in 100 ohm termination between TD+ and TD-; AC coupled thereafter
19	TD-	Transmitter inverted DATA in. See TD+
20	V_{EET}	Transmitter ground (common with receiver ground)

Table C-1: SFP Pinout Definitions

C.2. COM1 Cable: DB9 and Audio Jack Pinouts

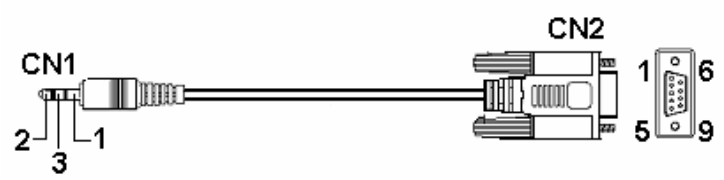

Figure C-2: Serial Port Cable CN1 and CN2 Connectors

COM 1 Cable: Connects a PC running a terminal emulation program

CN1 Pin Number	Pin Name
1	Ground
2	TXD
3	RXD

CN2 Pin Number	Pin Name
1	NC
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	NC
♦ Pin 4 and Pin 6 are shorted ♦ Pin 7 and Pin 8 are shorted	

Table C-2: COM 1 Cable, RS-232C CN1 and CN2 Pinout Definitions

NOTE:

Null modem is used for wire-swap. A null modem is necessary for connecting COM1 CN2 to a PC serial port.

C.3. GAL-9011 Null Modem

Swap pin 2 and pin 3
Swap pin 4 and pin 6
Swap pin 7 and pin 8

Table C-3: Null Modem Pinouts

C.4. Ethernet Port Pinouts

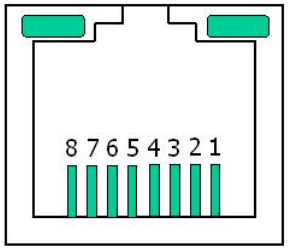

Figure C-3: Ethernet Port Pinouts

Pin	Pin Name	Pin	Pin Name
1	LAN_TXP	**5**	N2
2	LAN_TXN	**6**	LAN_RXN
3	LAN_RXP	**7**	N1
4	N2	**8**	N1

Table C-4: Ethernet Port Pinouts

C.5. Main Power

IEC-type receptacle.